RESULTS AND DISCUSSION

I- Growth attributes

1- Plant height:

Results in Table (3) present the means of plant height at different growth periods as influenced by sowing dates, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

A- Effect of sowing date:

The combined analysis clearly shows that plant height of rice at 75, 90 and 105 days from sowing was significantly affected by sowing dates. Early planting of rice May 15 th resulted in longer plants (100.52 and 107.34 cm), followed by that on June 1 st (93.32 and 99.28 cm) at 90 and 105 days from planting, respectively. Whereas the shortest ones (89.51 and 94.5 cm) were obtained from the latest sowing dates (June 15 th). On the other hand, the tallest plant at 75 days from sowing was 91.30 cm, obtained from sowing at the third date, whereas the shortest one (69.87 cm) was obtained from the first date. Plant height was increased as the plant advanced in age i. e. from 75 to 105 days. The high temp. at the late sowing may resulted in taller plants at the first sampling date. However, the early sowing gave normal plants which become taller as compared with the late sowing at the later stages.

These results may be due to favourable climatic conditions to rice at early sowing date i.e., the more favourable temperature, day length and longer growth duration. These results are in accordance with those obtained by Shaalan *et al.* (1981), Badawy (1982), El- Hity *et al.* (1987), Abd El- Rahman *et al.* (1992) and El- Kalla *et al.* (1994), they found that plant height was reduced with the delay of sowing dates.

B- Effect of N level:

Table (3) shows that plant height at different periods of rice growth were significantly increased by increasing level of nitrogen fertilizer up to 144 kg N/ ha. The application of nitrogen fertilizer at 144 kg N/ ha gave the tallest plant which was about 89.82, 101.63 and 109.41 cm at 75, 90 and 105 days from sowing respectively, whereas the shortest plant at the three samples were 67.26, 84.74 and 89.46 cm, respectively produced from the control treatment. This might be due to the role of nitrogen in stimulating the meristematic activity and cell elongation of plants. These results are in agreement with those obtained by El- Kerdy *et al.* (1979), Abd El- Rahman *et al.* (1986), Aly *et al.* (1986), El- Kalla *et al.* (1990), Thakur (1993) and Gorgy (1995).

C- Varietal differences:

The mean values of plant height was significantly influenced by rice cultivars under study at the three growth samples (Table 3). It was observed with Giza 177 at 75, 90 and 105 days from sowing. Whereas the difference between the average values of plant height of Giza 176 and Giza 177 cultivars were not significant at 75 and 90 days from sowing. On other hand, the shortest one was 92.27 cm, obtained from Giza 177 cultivar.

The differences between rice cultivars are attributed to the genetical- environmental interaction. This result is in line with these found by Shaalan *et al.* (1981), El- Hity *et al.* (1987), El- Kalla *et al.* (1990), Assey *et al.* (1992), El-Kalla *et al.* (1992), El- Kalla *et al.* (1994) and Gorgy (1995).

2- Number of tillers/ m^2:

Number of tillers/ m^2 as affected by sowing dates N- levels and rice cultivars at different growth stages in combined analysis of the two growing seasons are listed in Table (3).

A- Effect of sowing date:

Data shown in Table (3) confirmed that number of tillers/ m^2 was significantly decreased by delay in sowing dates from May, 15 to June 15 th. Early sowing on May 15 th gave the maximum number of tillers/ m^2 which equal to 748.38, 713.67 and 683.79 tillers/ m^2 at 75, 90 and 105 days from planting, respectively. However, the least ones were 667.78, 553.19 and 541.44 tillers/ m^2, respectively, produced from sowing on June, 15 at the respective sampling dates.

In general, number of tillers/ m^2 was decreased at the third sample when compared with the first sample may be due to the death of some tillers at the last growth stages.

It can be noticed that sowing rice on May 15 th gave the highest number of tillers/ m^2, this may be due to the favourable climatic conditions i.e., temperature, light and day length which affected number of days to flowering. Similar results were obtained by El- Aziz *et al.*

(1970), Shaalan *et al.* (1981), Badawy (1982), Badawi and Mahrous (1985), El- Hity *et al.* (1987), Assey *et al.* (1992), Abd El- Rahman *et al.* (1992) and El- Kalla *et al.* (1994).

B- Effect of N- level:

It is evident from Table (3) that there were progressive and consistent increases in number of tillers/ m^2 at the three samples in combined analysis at the two seasons.

The application of 144 kg N/ ha increased the mean values of number of tillers/ m^2 by 218.35, 193.5 and 239.51 tillers/ m2 at 75, 90 and 105 days from planting, respectively over untreated plants. It seem likely that as more nitrogen was supplied there was more uptake and consequently more growth.

It could be concluded that rice crop responded to high nitrogen level up to 144 N/ ha. This increase clearly indicated that prominent role of N on vegetative growth and tillering. Similar results were also reported by Sarathe *et al.* (1969), Dixit *et al.* (1979), El- Keredy *et al.* (1979), Badawi and Mahrous (1985), El- Kalla *et al.* (1990), Thakur (1993) and Gorgy (1995).

C- Varietal differences:

Data indicated clearly that there was a significant difference between the average number of tillers/ m^2 of the three cultivars of rice at the three stages. Giza 176 cultivar surpassed Giza 171 and Giza 177 in the number of tillers/ m^2 at 75, 90 and 105 days from planting. Such superiority in Giza 176 in number of tillers/ m2 may be due to the fact that Giza 176 is more vigorous in growth than the other cultivars.

These results are in harmony with those obtained by Dixit *et al.* (1979), Shaalan *et al.* (1981), El- Hity *et al.* (1987), El- Kalla *et al.* (1990), El-Kassaby *et al.* (1991), Assey *et al.* (1992), El- Kalla *et al.* (1992), Thakur (1993), El- Kalla *et al.* (1994) and Gorgy (1995), they showed that significant differences were detected among rice cultivar in number of tillers/ m^2.

3- Leaf area index:

Data listed in Table (3) show the effect of sowing dates, N-levels; and rice cultivars on leaf area index at different sampling periods from planting in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing date:

Leaf area index was significantly decreased by any delay for date of sowing at the three samples. It was clear that early sowing at mid- May had the highest values of leaf area index which equal 6.56, 6.14 and 3.36 at 75, 90 and 105 days from sowing. However, the lowest leaf area index was 5.09, 2.25 and 1.34 at the same periods, respectively, obtained from late sowing at mid-June. Also, leaf area index was decreased at the third sample. Whereas, the highest mean values of leaf area index was obtained from early sowing in the first and second samples as compared with the third sample.

The increase of leaf area index of rice may be attributed to the fact that early sowing leads to long growth seasons and this in turn gives plants a chance to utilize efficiently growth essentials i.e., nutrients , water and light.

These results are in accordance with those found by Ogat *et al.* (1988) and Wang and Liu (1991).

B- Effect of N- level:

Concerning nitrogen levels, results show a linear significant increase in leaf area index at all growth ages.

The application of 144 kg N/ ha increased leaf area index by 159.68, 134.20 and 177.78 % over the control treatment at 75, 90 and 105 days from sowing. Also, the highest leaf area index was 8.18, obtained from applied 144 kg N/ ha at 75 days from planting when compared to different periods of growth.

In general, N encouraged growth of leaf area as an essential element which plays a prominent role in building new merestimic cells, cell elongation and increasing photosynthesis activity of rice plants. This fact is valid since L.A.I value is calculated from dividing LA by land area.

Results reported by Stione and Steinmetz (1979), Chebataroff *et al.* (1984), Shaalan *et al.* (1986), Kreem (1993) and Gorgy (1995) they found that a linear significant increase in leaf area index due to the increase nitrogen fertilizer rates.

C- Varietal differences:

Results in table (3) showed highly significant differences existed among the three cultivars of rice under study at all growth periods.

height and these characters were associated with the increase in crop growth rate.

The results were in good connection with the result obtained by Assey *et al.* (1992).

B- Effect of N- level:

Crop growth rate values tended to increase significantly as N level increase up to 144 kg N/ ha. The application of 96 and 144 kg N/ ha increased CGR values by 30.95 and 63.14 %, respectively as compared with n check treatment at early period between 75- 90 days from sowing. The corresponding increases were 142.45 and 529.65 %, respectively at late period between 90- 105 days from sowing.

Also, the highest mean values of crop growth rate was 233.04 g/ m^2/ weak, obtained from applied 144 Kg N/ ha at 75- 90 days from sowing, whereas the lowest one was 25.23 g/ m^2 / weak, produced from the control treatment at 90- 105 days from sowing. This may be due to excessive vegetative growth caused by heavy shading followed by competition for light and then death of the lower leaves as well as decreased the rate of photosynthesis as suggested by Tanaka (1964).

Generally, the results showed that the increase of CGR was associated with an increase in Leaf area index at flowering stage as well as dry matter accumulation per unit land area (m^2).

In this connection other researchers, Palit *et al.* (1976), El-Keredy *et al.* (1979), Kreem (1993) and Gorgy (1995) reported that the CGR of rice plant was increased by increasing nitrogen rate.

C- Varietal differences:

Table (3) indicate that Giza 171 and Giza 176 cultivars surpassed significantly than Giza 177 cultivar in crop growth rate at the two growing periods of rice plant, whereas, Giza 177 cultivar gave the lowest values of crop growth rate. Giza 171 and Giza 176 cultivars surpassed Giza 177 cultivar. It might be attributed to higher dry weight and leaf area index in the plants of the two cultivars. Such findings could be attributed to genetic effects.

These results are in good agreement with those of Wang *et al.* (1991) and Gorgy (1995) who found that significant differences among varieties for crop growth rate.

5- Heading dates:

Results presented in Table (3) indicate that the effect of sowing dates, N- levels and rice cultivars on the number of days from planting to 50 % heading in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing date:

It was evident that date of rice heading was significantly affected by date of sowing (Table 3). Sowing date on June 15 th gave earlier plants than the other dates of sowing. Whereas, early planting of rice (May 15 th) caused a delay in heading date. It might be due to the sensitivity of the tested variety to the day length.

These results are in harmony with those obtained by Badawy (1982), Mahrous *et al.* (1986) and El- Hity *et al.* (1987), they found that the duration of growth from emergence to heading was substantially reduced with delaying date of sowing due to day light hours and day temperature were decreased.

B- Effect of N- level:

Data shown in Table (3) indicated that number of days to 50 % heading were significantly increased by increasing N level up to 144 kg N/ ha. It was clear that application of 96 and 144 kg N/ ha delayed heading time by about 1.4 and 4 days over the control treatment, respectively.

It could be concluded that rice plants were responsive to the high levels of nitrogen fertilizer. Such results are in accordance with those found by Dixit *et al.* (1979), Aly *et al.* (1986), El- Kalla *et al.* (1990), Peng and Li (1991) and Gorgy (1995).

C- Varietal differences:

Data in Table (3) show that there were significant differences in number of days to 50 % heading in the combined analysis of 1993 and 1994 seasons.

It was clear that Giza 177 cultivar was earlier in heading time followed by Giza 176 the latest cultivar in this respect. These differences among rice cultivars might be attributed to the genetic variability among the three cultivars of rice under study.

Similar results were obtained by Dixit *et al.* (1979), Singh and Paliwal (1980), Shaalan *et al.* (1981), Shaalan *et al.* (1986 a and b), El-Hity *et al.* (1987), El- Kalla *et al.* (1990) and Gorgy (1995).

Table (3): Plant height, number of tillers/ m^2, leaf area index and crop growth rate (at different growth periods) and heading date as affected by sowing dates, N- levels and rice cultivares in the combined analysis of 1993 and 1994 seasons.

Characters	Plant height (cm)			No. of tillers/ m^2			Leaf area index			Crop growth rate		Heading date
Period	75	90	105	75	90	105	75	90	105	75- 90	90- 105	
Sowing dates:												
Early	69.87 c	100.52 a	107.34 a	748.38 a	713.67 a	683.79 a	6.56 a	6.14 a	3.36 a	298.70 a	112.36 a	95.06 a
Medium	80.15 b	93.32 b	99.28 b	693.46 b	626.89 b	582.69 b	6.05 b	3.53 b	2.26 b	177.22 b	86.87 b	87.68 b
Late	91.30 a	89.51 c	94.50 c	667.78 c	553.19 c	541.44 c	5.09 c	2.25 c	1.34 c	87.05 c	46.04 c	80.96 c
N- level (kg/ ha):												
0	67.26 c	84.74 c	89.46 c	589.44 c	532.85 c	471.36 c	3.15 c	2.31 c	1.17 c	142.85 c	25.23 c	86.10 c
96	84.24 b	96.98 b	102.25 b	712.38 b	634.56 b	625.69 b	6.37 b	4.20 b	2.54 b	187.07 b	61.17 b	87.50 b
144	89.82 a	101.63 a	109.41 a	807.79 a	726.35 a	710.87 a	8.18 a	5.41 a	3.25 a	233.04 a	158.86 a	90.10 a
Cultivars:												
Giza 176	76.30 b	88.82 b	94.75 b	762.74 a	677.96 a	651.88 a	6.58 a	4.71 a	3.16 a	197.77 a	96.71 a	90.39 b
Giza 171	89.51 a	106.03 a	114.10 a	683.21 b	612.56 b	585.23 b	6.23 b	4.39 b	2.91 b	200.45 a	94.38 a	94.79 a
Giza 177	75.51 b	88.50 b	92.27 c	663.67 c	603.24 b	570.82 c	4.89 c	2.82 c	0.90 c	165.07 b	54.17 b	78.51 c

I- Interaction effect on growth attributes:

A- Interaction effect between sowing dates and N- levels:

A- 1- Plant height (cm):

The results in Table (4) revealed that the interaction between sowing dates and N levels had a significant effect on plant height at different samples of growth in combined analysis of 1993 and 1994 seasons.

At 75 days from planting, the tallest plant was 97.66 cm produced from late sowing when applied 144 kg N/ ha. However, the shortest plant was 55.93 cm obtained from early sowing without applied nitrogen.

On the other hand, at 90 and 105 days from planting the plant heights were 109.50 and 115.87 cm, respectively, produced from early sowing with the application of 144 kg N/ ha. while the minimum ones were 82.27 and 86.40 cm, at 90 and 105 days from sowing, respectively, obtaining from sowing at June, 15 th without application of nitrogen fertilization.

It could be concluded that sowing of rice at mid- May with increasing N level up to 144 kg N/ ha gave the tallest plant of rice.

A- 2- Number of tillers/ m^2:

Number of tillers/ m^2 was significantly affected by the interaction between sowing date and N level at the three growth periods in combined analysis over two growing seasons (Table 4).

The maximum numbers of tillers/ m^2 were 885.33, 868.87 and 853.62 at 75, 90, and 105 days from planting, respectively, found from sowing at early date with received 144 Kg N/ ha. On the other hand, the minimum ones were 567.33, 497.42 and 452, respectively, obtained from sowing at late date with the control treatment (zero N).

It could be concluded that early sowing at mid- May with increasing N level up to 144 kg N/ ha gave the maximum number of tillers/ m^2 at different growth periods of rice plants.

A- 3- Leaf area index:

Data in Table (4) indicated that there were significant differences in leaf area index by the interaction between sowing date and N level at the three samples of growth in combined analysis of 1993 and 1994 seasons.

Leaf area index was increased by increasing N level when rice planted at May, 15. The highest leaf area index were 8.69, 8.75 and 4.45 at 75, 90 and 105 days from planting, respectively, produced from sowing at mid- May with application of 144 kg N/ ha, whereas the late sowing without nitrogen fertilizer gave the lowest values (2.66, 1.66 and 0.54 at different growth period, respectively).

It was clearly noticed that, leaf area index gave the same trend of plant height and number of tillers/ m^2 as affected by the interaction between sowing dates and N- levels.

Table (4): Plant height, number of tillers/ m^2, leaf area index (at different growth periods) and heading date as affected by the interaction between sowing dates, N- levels in combined analysis of 1993 and 1994 seasons.

Characters		Plant height (cm)			No. of tillers/ m^2			Leaf area index			Heading date
Period (days)		75	90	105	75	90	105	75	90	105	
Sowing date:	N-levels: kg/ ha										
Early	00	55.93	87.46	95.94	597.33	560.46	492.67	3.69	2.99	2.16	93.25
	96	73.11	104.60	110.21	762.46	711.67	705.08	7.29	6.68	3.48	95.12
	144	80.57	109.50	115.87	885.33	868.87	853.62	8.69	8.75	4.45	96.79
Medium	00	64.57	84.49	86.05	603.67	540.67	469.42	3.23	2.28	0.83	85.83
	96	84.65	94.70	101.21	698.00	640.67	609.67	6.53	3.74	2.69	86.87
	144	91.23	100.77	110.60	778.71	699.33	669.00	8.37	4.56	3.27	90.33
Late	00	81.27	82.27	86.40	567.33	497.42	452.00	2.51	1.66	0.54	79.21
	96	94.97	91.64	95.34	676.67	551.33	562.33	5.28	2.18	1.45	80.50
	144	97.66	94.63	101.77	759.33	610.83	610.00	7.48	2.90	2.03	83.17
L.S.D at 5%		1.51	1.84	2.09	19.62	27.20	17.82	0.29	0.16	0.11	0.62

A- 4- Heading date:

A significant effect of the interaction between sowing date and N level on number of days to 50 % heading was observed in combined analysis as shown in Table (4).

The late sowing with different N levels gave earlier plants compared to early sowing with the same levels of nitrogen fertilizer. The maximum number of days to 50 % heading was 96.79 days, obtained from sowing at May 15 *th* with increasing N level up to 144 kg N/ ha, while the maximum one was 79.21 days, produced from sowing at June 15 *th* without nitrogen fertilizer. Number of days to heading was drastically minimized in the late sowing of rice. Thus, the plants turned quickly to flowering irrespective of their size.

It could be concluded that early sowing on May 15 *th* with 144 kg N/ ha gave the greatest growth of rice.

B- Interaction effect between sowing dates and cultivars:

B- 1- Plant height:

Table (5) showed that the interaction between sowing dates and cultivars was significant on plant height at 75 and 90 days from planting.

It was clear that Giza 171 cultivar with sowing at 15 th of June gave the tallest plants (102.80 cm) at 75 days from planting. However, the shortest plant of rice was 65.99 cm, produced from Giza 177 cultivar when sown at of May 15 *th* . On the other hand, the highest plant height was 110.33 cm, obtained from Giza 171 cultivar when sown on May 15 *th*, whereas the lowest one was 82.92 cm, produced from Giza 176 planted on late date of sowing in the second sample (at 90 days from sowing). However, the differences between Giza 176 and Giza 177 cultivar which planted at June, 1 st and June 15 th were not significant in plant height at 75 and 90 days from planting.

These results are in harmony with those obtained by Wade and Johnston (1975) and Badawy (1982) who found that the plants of most cultivars were tallest from May seedlings and shorted from June seedlings.

B- 2- Number of tillers/ m^2:

Number of tillers/ m^2 as influenced by the interaction between sowing dates and rice cultivars at 75 and 105 days from planting was significant in the combined analysis of the two growing seasons (Table 5).

It was clear that, Giza 176 cultivar at early sowing gave the maximum number of tillers/ m^2 which equal 813.33 and 728.21 at 75 and 105 days from planting, respectively. Also, at any of the tested date of sowing either Giza 171 or Giza 177 cultivars were inferior to Giza 176 cultivar on number of tillers/ m^2 at different growth period.

It could be concluded that Giza 176 cultivar had markedly decreased in number of tillers/ m^2 due to the delay in sowing date. Similar trend was found by Badawy (1982).

B- 3- Leaf area index:

Results in Table (5) indicated that the interaction between sowing dates and rice cultivars had a significant effect on leaf area index at different growth period.

Table (5): Plant height, number of tillers/ m^2, leaf area index (at different growth periods) and heading date as affected by the interaction between sowing dates, and rice cultivares in combined analysis of 1993 and 1994 seasons.

Characters		Plant height (cm)		No. of tillers/ m^2		Leaf area index			Heading date
Period (days)		75	90	75	105	75	90	105	
Sowing dates:	Cultivars:								
Early	Giza 176	67.60	97.15	813.33	728.21	7.51	6.94	4.80	98.96
	Giza 171	76.01	110.33	749.12	676.54	6.96	6.87	4.03	104.33
	Giza 177	65.99	94.08	682.67	646.62	5.21	4.61	1.27	81.87
Medium	Giza 176	76.06	86.40	760.21	642.08	6.79	4.39	3.28	90.17
	Giza 171	89.73	105.55	664.50	562.83	6.36	3.91	2.78	94.54
	Giza 177	74.66	88.00	655.67	543.17	4.98	2.28	0.73	78.33
Late	Giza 176	85.25	82.92	714.67	585.33	5.44	2.80	1.40	82.04
	Giza 171	102.80	102.21	636.00	516.33	5.36	2.38	1.90	85.50
	Giza 177	85.86	83.40	652.67	522.67	4.47	1.57	0.70	75.33
L.S.D at 5%		1.52	1.95	24.03	20.34	0.27	0.16	0.10	0.63

The highest leaf area indices were 7.51, 6.94 and 4.80, obtained from sowing at early date (May 15 th) with Giza 176 cultivar in the three tested samples (at 75, 90 and 105 days from sowing), respectively, whereas the lowest L.A.I were 4.47, 1.57 and 0.70 in the same previously mentioned samples respectively, when Giza 177 broadcasted at the late date of sowing (June 15 th). Also, Giza 176 cultivar was superior in leaf area index compared to the other cultivars at all sowing dates. But the most cultivars under study with delay in sowing date caused a decrease in leaf area index at different growth period.

B- 4- Heading date:

Data in Table (5) indicated that there were significant differences in the interaction between sowing dates and rice cultivars on number of days to 50 % heading.

It is evident that, under early sowing, Giza 171 cultivar was late in heading time than Giza 176 and Giza 177 cultivars. While, Giza 177 cultivar reached to heading date earlier with delay in date of sowing up to June 15 th. Also, number of days to 50 % heading was decreased by any delay in sowing date with the three cultivars of rice under study. These results are in accordance with those obtained by Badawy (1982) and El- Hity *et al.* (1987).

C- Interaction effect between N- levels and cultivars:

C- 1- Plant height:

Plant height at different growth period was significantly affected by the interaction between N levels and rice cultivars (Table 6).

The tallest plants were 101.31, 114.94 and 124.87 cm, produced from Giza 171 cultivar with the application of 144 kg N/ ha at 75, 90 and 105 days from sowing, respectively. Whereas, the shortest plants were 62.15, 80.12 and 82.05 cm, respectively, produced from Giza 177 cultivar without application of nitrogen fertilizer.

It was observed that Giza 177 cultivar responded more to nitrogen up to 144 kg N/ ha. Similar results were obtained by Abdella (1985), Shaalan *et al.* (1986), Badawi *et al.* (1990) and Gorgy (1995).

C- 2- Number of tillers/ m^2:

Results in Table (6) indicated that the interaction between rice cultivars and nitrogen levels had significant effect on number of tillers/ m^2 at 75 days from sowing only. On the other hand, no significant difference was obtained by the interaction between cultivars and N levels in number of tillers/ m^2 at the first and third samples under study. Consequently, the data were excluded.

The maximum number of tillers/ m^2 was 863.54, obtained from Giza 176 cultivar when received 144 kg N/ ha at 75 days from planting. While Giza 171 and Giza 177 cultivars without nitrogen fertilizer produced the minimum number of tillers/ m^2 (55.767 and 570.00, respectively).

In general, number of tillers/ m^2 of the three tested cultivars was increased by increasing N level up to 144 kg N/ ha. The same results were obtained by Abdella (1985).

Table (6): Plant height, number of tillers/ m^2, leaf area index (at different growth periods) and heading date as affected by the interaction between N- levels and rice cultivares in combined analysis of 1993 and 1994 seasons.

Characters		Plant height (cm)			No. of tillers/ m^2	Leaf area index			Heading date
Period (days)		75	90	105	75	75	90	105	
N-levels:(kg/ha)	Cultivars:								
00	Giza 176	65.72	80.19	86.12	640.67	3.65	2.88	1.60	88.87
	Giza 171	73.89	93.99	100.22	557.67	3.00	2.54	1.43	92.50
	Giza 177	62.15	80.12	82.05	570.00	2.78	1.52	0.50	76.92
96	Giza 176	79.76	91.05	95.42	784.00	7.43	5.16	3.51	89.62
	Giza 171	93.34	109.25	117.22	696.46	6.85	4.49	3.20	94.37
	Giza 177	79.65	90.64	94.11	656.67	4.82	2.94	0.91	78.50
144	Giza 176	83.43	95.23	102.71	863.54	8.65	6.09	4.37	92.67
	Giza 171	101.31	114.94	124.87	795.50	8.84	6.13	4.09	97.50
	Giza 177	84.72	94.72	100.65	764.33	7.05	4.00	1.29	80.12
L.S.D at 5%		1.71	1.95	1.99	24.06	0.27	0.16	0.10	0.63

C- 3- Leaf area index:

Leaf area index was significantly affected by the interaction between N levels and rice cultivars (Table 6).

The highest leaf area index was obtained from Giza 171 or Giza 176 cultivars with increasing N level up to 144 kg N/ ha at the three tested samples of growth. Whereas, the lowest L.A.I was obtained from Giza 177 cultivar without application of nitrogen fertilizer.

It could be concluded that Giza 171 and Giza 176 cultivars responded more to nitrogen fertilizer up to 144 kg N/ ha.

C- 4- Heading dates:

Data in Table (6) demonstrated that there was a reverse relationship between N levels and heading time for the three tested cultivars of rice. Giza 171, Giza 176 and Giza 177 cultivars were delayed heading time by about 5, 3.8 and 3.2 days, respectively when N level increased to 144 kg N/ ha as compared with control.

It is noticed that, Giza 171 cultivar fertilized by 144 kg N/ ha had a significant increased in the number of days to heading. On other hand, Giza 177 cultivar without application of nitrogen gave the lowest number of days to heading as compared to the other tested cultivars.

D- Interaction effect between sowing dates, N- levels and cultivars:

D- 1- Plant height:

Plant height was significantly affected by the interaction between sowing dates, N- levels and rice cultivars at different growth period in combined analysis of the two growing seasons as shown in Table (7).

At 75 days from planting, the tallest plant was 110.56 cm, obtained from Giza 171 cultivar when fertilized by 144 kg N/ ha and sown on June 15 th, whereas the shortest plant was 50. 62 cm, obtained from Giza 177 cultivar when planted in early sowing (May 15 *th*) without application of nitrogen fertilizer.

On the other hand, Giza 171 cultivar when sowing at early date and received 144 kg N/ ha gave the highest plant height at 90 and 105 days from planting (121.37 and 133.04 cm), respectively. While the lowest plant height was 74.44 and 78.62, respectively, obtained from Giza 177 cultivar when planted in June, 15 without application of nitrogen fertilizer.

D- 2- Number of tillers/ m^2:

Results in Table (7) indicated that there were significant differences in the number of tillers/ m^2 as influenced by the interaction between sowing dates, N-levels and rice cultivars at 75 and 105 days from planting.

However, no significant differences in number of tillers/ m^2 at 90 days from planting as affected by the interaction between the factors under study.

Giza 176 cultivar fertilized by 144 kg N/ ha, and planted in the early date gave the maximum number of tillers/ m^2 (936 and 896.87 at 75 and 105 days from planting). Whereas, the minimum one was 514, produced from sowing at late without N fertilizer to Giza 171 at 75 days from planting. On the other hand, no significant difference of the

Table (7): Plant height and number of tillers/ m^2 (at different growth periods as affected by the interaction between sowing dates. N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		Plant height (cm)									No. of tillers/ m^2					
Periods (days)		75			90			105			75			105		
Cultivars		G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G.177	G. 176	G. 171	G. 177
Sowing dates:	**N- levels: kg/ ha**															
Early	00	56.91	60.25	50.62	86.12	93.37	82.87	94.07	106.85	86.90	648.0	600.0	544	544.37	468.6	465.0
	96	70.05	78.49	70.80	101.44	116.25	96.12	103.91	124.74	101.96	856.0	727.4	704	743.37	698.0	673.9
	144	75.85	89.29	76.56	103.87	121.37	103.25	108.36	133.04	106.21	936.0	920.0	800	896.87	863.0	801.0
Medium	00	62.84	69.50	61.37	78.07	92.62	82.76	83.75	93.76	80.62	666.0	559.0	586	516.75	468.5	423.0
	96	81.34	95.62	77.00	87.56	107.12	89.42	93.62	118.12	91.87	770.0	698.0	626	680.50	587.0	561.5
	144	84.00	104.07	85.61	93.57	116.90	91.82	104.75	125.05	102.00	844.6	736.5	755	729.00	633.0	645.0
Late	00	77.42	91.94	74.46	76.37	95.70	74.44	80.54	100.04	78.62	608.0	514.0	580	514.00	438.0	404.0
	96	87.89	105.90	91.14	84.15	104.39	86.37	88.73	108.79	88.50	726.0	664.0	640	608.00	535.0	544.0
	144	90.44	110.56	91.97	88.24	106.55	89.10	95.01	116.54	93.75	810.0	730.0	738	634.00	576.0	620.0
L.S.D at 5%		2.96			3.37			3.44			41.58			35.23		

interaction between Giza 171 or Giza 177 cultivars when sowing at late date without N fertilization on number of tillers/ m^2 at 105 days from planting.

D- 3- Leaf area index:

The effect of the interaction between sowing dates, N- levels and rice cultivars on leaf area index at all growth stages were significant in combined analysis of 1993 and 1994 seasons as shown in Table (8).

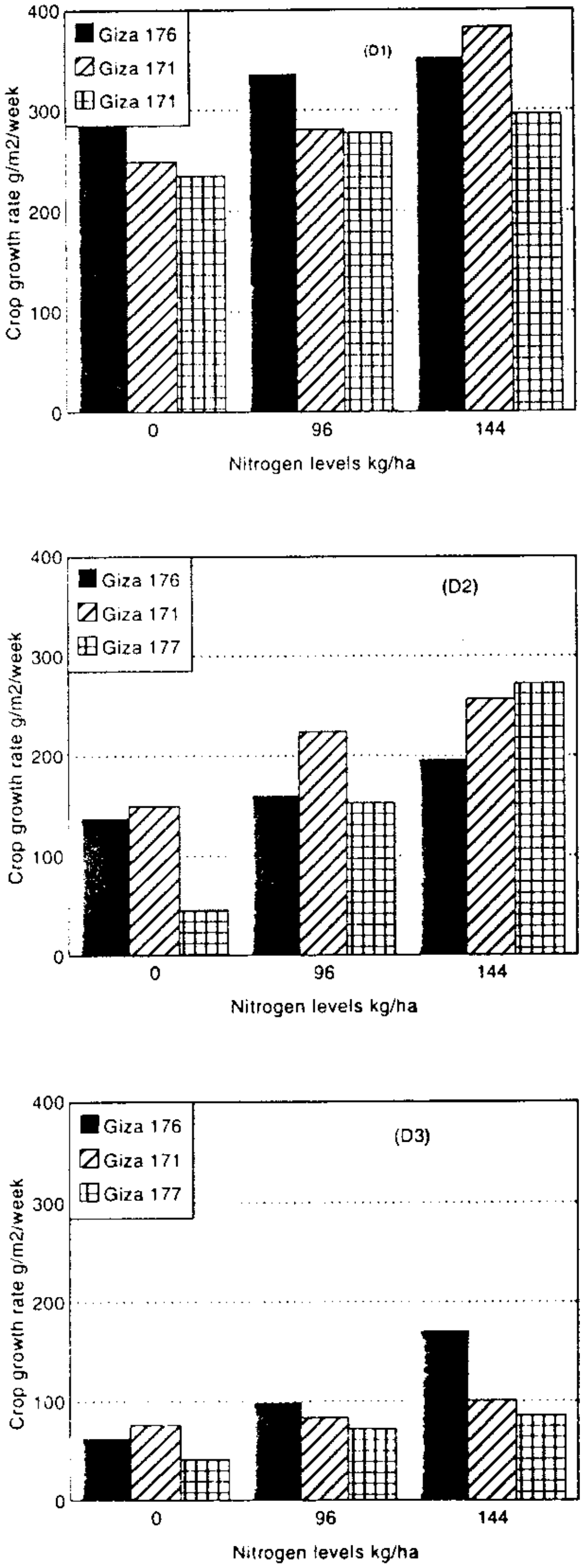
The greatest leaf area index was 9.45 and 10.07, obtained from sowing at early date with 144 kg N/ ha to Giza 171 cultivar at 75 and 90 days from planting, respectively. Whereas, Giza 176 cultivar with applied 144 kg N/ ha when sowing at early date gave the maximum leaf area index (6.18) at 105 days from planting. On the contrary, the minimum ones were obtained from Giza 177 cultivar when sown at late date of sowing without nitrogen fertilizer at the three periods of growth.

It could be concluded that either Giza 171 or Giza 176 when sowing at early date of sowing with increasing N levels up to 144 kg N/ ha gave the greatest LAI of rice.

D- 4- Crop growth rate (CGR):

Figures (1 and 2) showed that the effect of the interaction between sowing date, N- level and rice cultivar were differed on crop growth rate (CGR) at 75- 90 and 90- 105 days from sowing in combined analysis between the two growing seasons.

Figure (1) showed the highest crop growth rate, was obtained from applying 144 kg N/ ha to Giza 171, Giza 176 and Giza 177

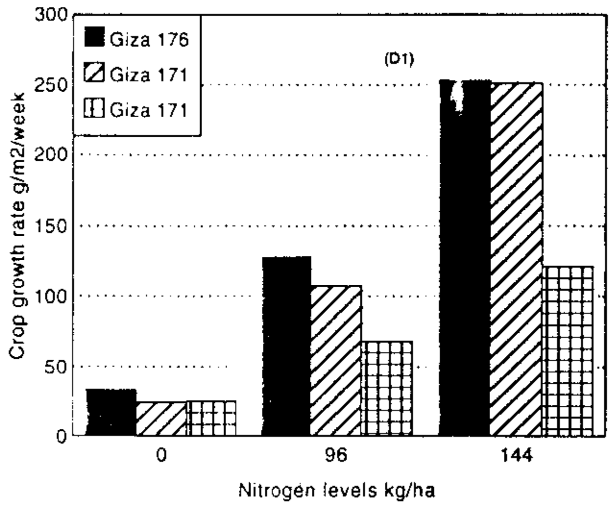


D1 Early date,

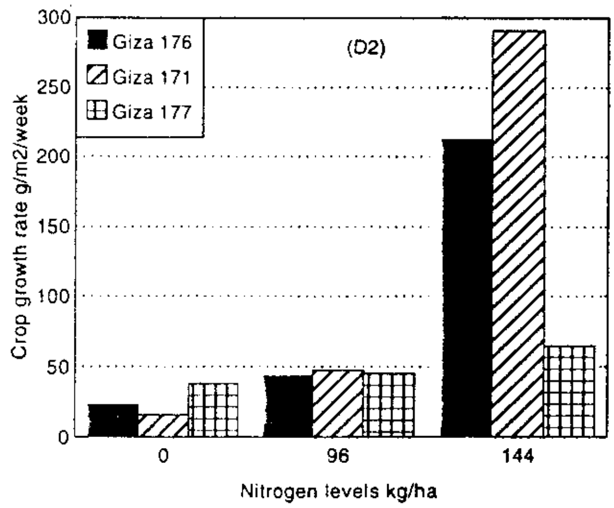
D2 Medium datc,

D3 Late date.

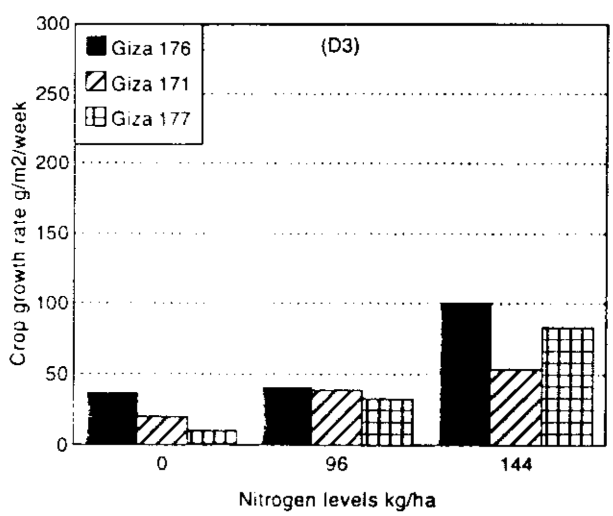
Figure (1). Effect of sowing date, N level and rice cultivar on crop growth rate during 75- 90 days from sowing.



D1 Early date,



D2 Medium date,



D3 Late date.

Figure (2): Effect of sowing date, N level and rice cultivar on crop growth rate during 90- 105 days from sowing

Table (8): Leaf area index (at different growth periods) and heading dates as affected by the interaction between sowing date, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		Leaf area index									Heading date		
Period (days)		75			90			105					
Cultivars		G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177
Sowing dates:	**N- levels: kg/ ha**												
Early	00	4.78	3.35	2.94	3.79	3.37	1.81	3.16	2.48	0.84	97.50	102.50	79.75
	96	8.46	8.09	5.33	7.82	7.18	5.03	5.05	4.11	1.28	98.87	104.50	82.00
	144	9.27	9.45	7.36	9.21	10.07	6.98	6.18	5.50	1.67	100.50	106.00	83.87
Medium	00	3.62	3.18	2.90	2.87	2.56	1.41	1.04	1.15	0.29	89.00	92.00	76.50
	96	8.07	6.76	4.76	4.81	4.02	2.37	4.08	3.27	0.72	88.50	93.62	78.50
	144	8.69	9.13	7.28	5.50	5.14	3.06	4.73	3.91	1.17	93.00	98.00	80.00
Late	00	2.55	2.47	2.50	1.97	1.68	1.33	0.61	0.65	0.35	80.12	83.00	74.50
	96	5.77	5.69	4.38	2.86	2.27	1.41	1.40	2.21	0.73	81.50	85.00	75.00
	144	7.99	7.93	6.52	3.56.	3.19	1.96	2.20	2.86	1.02	84.50	88.50	76.50
L.S.D. at 5%		0.47			0.28			0.17			1.09		

cultivars when sowing at May 15 th, June, 1 st and of June 15 th, respectively. On the contrary, Giza 177 cultivar without nitrogen fertilizer at any sowing date gave the lowest crop growth rate at 75- 90 days from sowing.

It was evident from Figure (2) that no difference between Giza 171 and Giza 176 cultivars and applied 144 kg N/ ha when early sowing. As well as crop growth rate at 90- 105 days from sowing gave the same trend at 75- 90 days from sowing, whereas CGR at 90- 105 days from sowing were lowest as comparing with the first growth period (75- 90 days). This may be due to excessive vegetative growth caused by heavy shading followed by competition for light and then death of the lowers leaves as well as decreased the rate of photosynthesis as reported by Tanaka (1964).

D- 5- Heading date:

Results in Table (8) revealed that highly significant differences in heading date as affected by the interaction between sowing dates, N levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Giza 177 cultivar without nitrogen at late sowing was the earliest in heading (74.5). While, Giza 171 cultivar with applied 144 kg N/ ha when early sowing was the latest one (106 days).

In general, number of days to 50 % heading of rice was increased by increasing N levels and decreased by delaying sowing date with the three cultivars under study.

II- Yield and yield components:

1- Panicle length:

Panicle length as influenced by date of sowing, N- levels and rice cultivars in combined analysis of the two growing seasons are presented in Table (9).

A- Effect of sowing date:

Data recorded in Table (9) show that date of sowing had a significant effect in panicle length.

Late sowing at June 15 th resulted in shorter panicles compared with both early sowing in May 15 th thand medium sowing in June 1 st. Early sowing and medium sowing increased panicle length by 15.58 and 8.48 %, respectively over the late sowing. This result may be due to the less competition for growth elements.

These results agree with those reported by Badawy (1982), Badawi and Mahrous (1985), Mahrous *et al.* (1986), Assey *et al.* (1992), Abd El- Rahman *et al.* (1992) and El- Kalla *et al.* (1994).

B- Effect of N- level:

Data in Table (9) revealed that panicle length significantly increased by increasing N- level up to 144 kg N/ ha in combined analysis of 1993 and 1994 seasons. The application of 96 and 144 kg N/ ha increased panicle length by 13.48 % and 18.83 %, respectively over the control treatment. This might be due to the favourable effect of nitrogen on rice plants and this in turn encouraged the growth of rice plants and subsequently the panicle length.

The present finding is in agreement with those obtained by Dixit *et al.* (1979), El- Keredy *et al.* (1979), Badawi and Mahrous (1985), Badwai *et al.* (1990), El- Kalla *et al.* (1992), Koriem *et al.* (1992) and Thakur (1993).

C- Varietal differences:

Data indicated clearly that there was a significant difference among three rice cultivars in panicle length in combined analysis of the two seasons. Giza 176 cultivar gave the tallest panicle followed by Giza 171, whereas Giza 177 cultivar had the shortest panicle. This result might be due to the differences in the genetic constitution of these varieties. This result is inclosed with that reported by Dixit *et al.* (1979), El- Kalla *et al.* (1992) and Thakur (1993).

2- Number of filled grains/ panicle:

Number of filled grains/ panicle as affected by sowing dates, N-levels and rice cultivars in combined analysis of the two growing seasons are presented in Table (9).

A- Effect of sowing dates:

Number of filled grains/ panicle significantly decreased by delay in dates of sowing from May 15 th to June 15 th.

The highest number of filled grains/ panicle was 92.56 recorded at early sowing date (May 15 th). However, the lowest one was 70.51, obtained from late sowing at June 15 th. The higher number of filled grains/ panicle may be a function of taller panicles and number of branches panicle at this sowing date. This result is confirmed with those obtained by El- Azizi *et al.* (1970), Badawy (1982), Badawi and Mahrous (1985), Mahrous *et al.* (1986), Assey *et al.* (1992), Abd El-Rahman *et al.* (1992) and El- Kalla *et al.* (1994).

B- Effect of N- level:

It was clear from Table (9) that a highly significant effect of nitrogen in number of filled grains/ panicle. The application of 96 and 144 kg N/ ha increased number of filled grains/ panicle by 14.22 % and 21.35 %, respectively over without application of nitrogen fertilizer. These increases might be attributed to favourable effect of nitrogen fertilizer in panicle length and number of branches/ panicle.

Similar results were obtained by Dixit *et al.* (1979), Barnes (1979), Barnes (1985), Badawi and Mahrous (1985), Aly *et al.* (1986), El- Kalla *et al.* (1990), El- Kalla *et al.* (1992), Koriem *et al.* (1992), Kreem (1993), Thakur (1993) and Gorgy (1995).

C- Varietal differences:

It was evident that Giza 176 cultivar significantly surpassed Giza 171 and Giza 177 cultivars in number of filled grains/ panicle in combined date (Table 9). On the other hand, Giza 177 cultivar gave the lowest number of filled grains/ panicle. In general, the trend of results are similar to those of heading times and could be attributed to genotype.

This result is in accordance with those found by Dixit *et al.* (1979), Shaalan *et al.* (1986 b), Badawi *et al.* (1990), El- Kalla *et al.* (1990), El- Kassaby *et al.* (1991), Assey *et al.* (1992), El- Kalla *et al.* (1992), Thakur (1993), El- Kalla *et al.* (1994) and Gorgy (1995).

3- Number of unfilled grains/ panicle:

Data in Table (9) illustrated that the effect of sowing dates, N-levels and rice cultivars on number of unfilled grains/ panicle in combined analysis of the two growing seasons.

A- Effect of sowing date:

Number of unfilled grains/ panicle was significantly affected by the different dates of sowing.

It can be noticed that sowing rice in June 15 *th* gave the highest number of unfilled grains/ panicle (12.89), whereas the lowest one was 6.1, obtained from sowing at May 15 *th*.

It could be concluded that delaying sowing date of rice from May 15 *th* to June 15 *th* significantly increased number of unfilled grains/ panicle. The low temperature through the ripening period may be the possible reason for such result. Also, number of unfilled grain was decreased at early sowing may be due to more favourable climatic conditions, i.e., temperature, day length and long duration of the vegetative growth period of the early sowing. These results are in fit with the results obtained by Badawy (1982) and Mahrous *et al.* (1986).

B- Effect of N- level:

Table (9) shows that number of unfilled grains/ panicle significantly increased by increasing N- level up to 144 kg N/ ha in combined data.

The highest number of unfilled grains/ panicle was 10.75, produced from adding 144 kg N/ ha., whereas the lowest one was

7.09, obtained from without application of nitrogen fertilizer. In fact, such increasing in number of sterile grain did not decrease grain yield because the number of fertile grains/ panicle was significantly higher than that increasing unfilled grains under N levels up to 144 kg N/ ha. Similar trend was obtained by Abdella (1985) and Koriem *et al.* (1992). On the other hand, Mahrous *et al.* (1986) showed that nitrogen levels did not affect the number of unfilled grains may be attributed to enough native nitrogen and the berseem clover which proceeded the rice crop.

C- Varietal differences:

Table (9) shows that the differences between rice cultivars were significant for number of unfilled grains/ panicle in combined analysis of the two seasons.

It was clear that Giza 176 cultivar gave the highest number of unfilled grains/ panicle (10.68). While the lowest one was 7.32, obtained from Giza 177 cultivar. This was expected because Giza 176 cultivar is characterized by high tillering ability and a relatively high number of sterile grains. These results are in harmony with the data obtained by Infeled and Silveira (1985).

4- 1000- grain weight:

1000- grain weight as affected by sowing dates, N- levels and rice cultivars in the combined data are listed in Table (9).

A- Effect of sowing date:

Data in Table (9) reveal that significant difference was detected among the thousand grain weight due to sowing dates. Sowing rice in early date produced the greatest 1000- grain weight (26.56 g) followed by that sown on medium date which gave 25.35 g. Delaying sowing rice to June g 15 th ave the lowest one (23.01 g).

These findings are in accordance with Badawy (1982), Shaalan *et al.* (1981), Badawi and Mahrous (1985), Mahrous *et al.* (1986), Assey *et al.* (1992), Abd El- Rahman *et al.* (1992) and El- Kalla *et al.* (1994).

B- Effect of N level:

The results in table (9) indicated that nitrogen levels had a significant effect on 1000- grain weight in the combined data.

The application of 96 and 144 kg N/ ha increased 1000- grain weight by 4.01 and 8.47 %, respectively over the check treatment. Nitrogen application level showed a similar effect as those obtained on panicle length and number of filled grains/ panicle. The nitrogen fertilizer increased the amount of photosynthetic acumulation by plants to which the dry matter content is a reliable index, and this in turn might account much for the superiority of 1000- grain weight. This view could be in line with those found by Aly *et al.* (1986), Pandy and Singh (1987), El- Kalla *et al.* (1990) and El- Kalla *et al.* (1992).

C- Varietal differences:

Data in Table (9) revealed that 1000- grain weight differed significantly between the three cultivars of rice under study. Giza 177 cultivar produced the heaviest 1000- grain weight (27.26 g), while Giza 171 cultivar expressed the lowest value (23.47 g). The increase in

1000- grain weight of Giza 177 cultivar may be due to a decrease in number of filled grains per panicle. These differences may be due to the differences in the genetical structure and its interaction with the environmental conditions. These results are in accordance with those recorded by Shaalan *et al.* (1986 a), Shaalan *et al.* (1986b), Badawi *et al.* (1990), El- Kalla *et al.* (1990), El- Kassaby *et al.* (1991), Assey *et al.* (1992), El- Kalla *et al.* (1992), Thakur (1993), El- Kalla *et al.* (1994) and Gorgy (1995).

5- Spikelet formation efficiency:

Data in Table (9) indicated that the effect of sowing dates, N levels and rice cultivars on spikelet formation efficiency (number of spikelets/ g N absorbed) in combined analysis of the two growing seasons.

A- Effect of sowing dates:

Spikelets formation efficiency was significantly affected by dates of sowing. Early date of sowing (May 15 th) gave the maximum number of spikelets/ g N absorbed (2906.78). Whereas, late date of sowing (June 15 th) gave the minimum value in this aspect (2588.26).

It could be concluded that nitrogen efficiency was higher on early sowing of rice than delaying dates of sowing. The increase in number of spikelets may be due to increase in flag leaf area, crop growth rate and panicle length.

B- Effect of N- level:

Spikelets formation efficiency was significantly affected by application of nitrogen fertilizer (Table 9). The highest number of spikelets/ g nitrogen absorbed was 2938.35, obtained when rice received 96 kg N/ ha. On the other hand, the lowest one was 2438.83, produced from control (zero nitrogen fertilizer).

The same trend was obtained by Pandy and Singh (1987), Yanni and Hegazy (1990), Peng and Li (1991), Singh *et al.* (1991), Upadhyay and Patel (1992) and Kreem (1993) they found that N use efficiency was greatest with increasing N fertilizer.

C- Varietal differences:

The results in Table (9) showed a highly significant difference among the three tested rice cultivars. Giza 176 cultivar significantly surpassed the other rice cultivars in number of spikelets/ g N absorbed (2861.40) followed by Giza 171 cultivar (2735.56), while Giza 177 gave the lowest one (2658.39) in combined data. However, no significant difference between Giza 171 and Giza 177 cultivar in the above character.

It could be concluded that Giza 176 cultivar was the best in N use efficiency to produce the highest panicle length, number of spikelets and number of filled grains. The total quantity of N used by the rice plant is related to varietal duration. The long duration rice absorbed more total N but less response to N fertilizer than shorter duration varieties (De Datta, 1986).

Table (9): Some yield component characters of rice as affected by sowing dates, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters / Treatments	Panicle length (cm)	No. of filled grains/ panicle	No. of unfilled grains/ panicle	1000-grain weight (g)	No. of spikelets/ g N absorbed
Sowing dates:					
Early	18.29 a	92.56 a	6.10 c	26.56 a	2906.78 a
Medium	17.02 b	82.15 b	8.64 b	25.35 b	2760.31 b
Late	15.69 c	70.51 c	12.89 a	23.01 c	2588.26 c
N- Level: (kg/ ha)					
00	15.35 c	72.78 c	7.09 c	23.97 c	2438.83 b
96	17.42 b	83.13 b	9.75 b	24.95 b	2938.35 a
144	18.24 a	88.32 a	10.75 a	26.00 a	2878.17 a
Cultivars:					
Giza 176	18.18 a	90.95 a	10.68 a	24.19 b	2861.40 a
Giza 171	17.12 b	85.07 b	9.60 b	23.47 c	2735.56 b
Giza 177	15.71 c	69.17 c	7.32 c	27.26 a	2658.39 b

6- Utilization efficiency:

Utilization efficiency of N fertilizer as influenced by sowing dates and rice cultivar under different N levels in combined analysis of 1993 and 1994 seasons are illustrated in Figure (3).

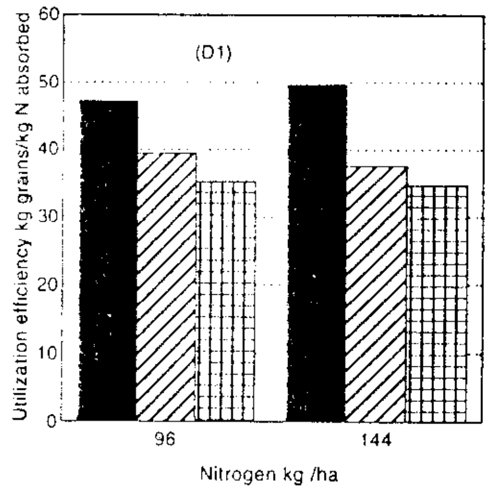
It was noticed that utilization efficiency was higher in the first date than the other two dates of sowing. Early sowing caused longer duration in rice cultivar and more N absorbance than the other dates of sowing.

As for N- levels Fig (3) illustrated that the application of 144 kg N/ ha caused an increase in utilization efficiency while 96 kg N/ ha gave the least one.

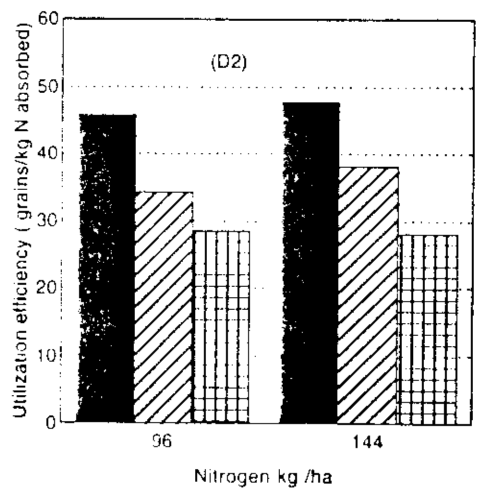
Also, there were highly differences among the three cultivars of rice. Giza 176 cultivar gave the maximum utilization efficiency followed by Giza 171 cultivar, while Giza 177 cultivar produced the minimum one.

Figure (3) showed no difference between 96 and 144 kg N// ha in utilization efficiency when rice planted at earlier date (May 15 th), while the application of 144 kg N/ ha gave more utilization efficiency than 96 kg N/ ha in the medium and late date of sowing.

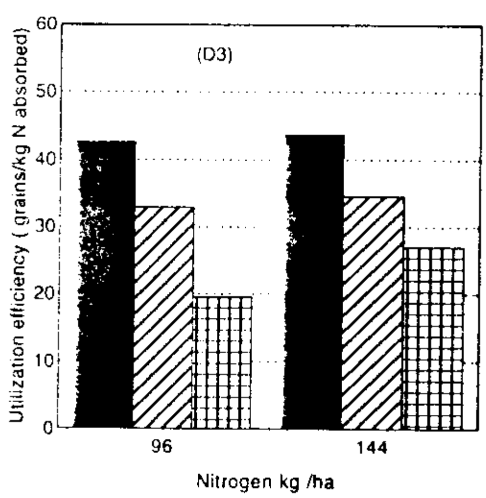
The application of 144 kg N/ ha to Giza 176 cultivar in the first and second date of sowing gave the highest utilization efficiency, while the lowest one was obtained when Giza 177 cultivar fertilized by 96 kg N/ ha in the 3^{rd} date of sowing.



D1 Early date,



D2 Medium date,



D3 Late date.

Figure (3): Effect of sowing date, N level and rice cultivar on utilization efficiency in the combined analysis of 1993 and 1994 seasons.

Singh *et al.* (1991), Upadhyay and Patel (1992) concluded that N use efficiency was greatest with 60 kg N/ ha and 50 kg N/ ha, respectively. On the other hand, Jakhro (1986) found that N use efficiency and utilization efficiency decreased at the rates of 250 kg N/ ha.

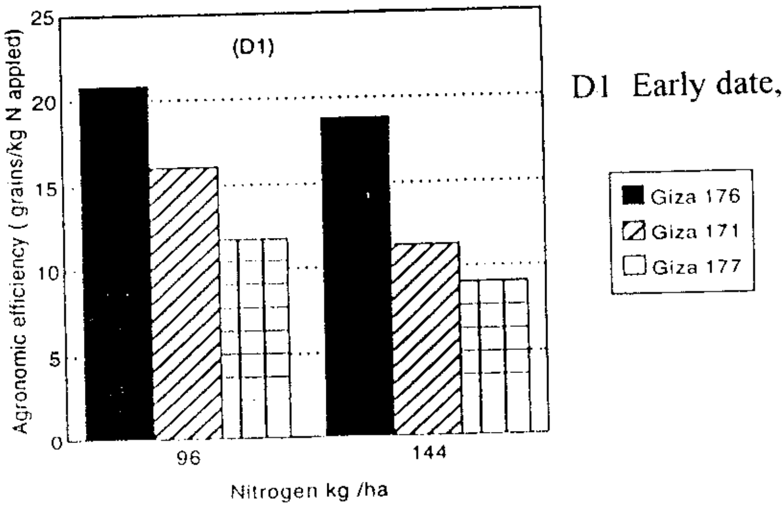
7- Agronomic efficiency:

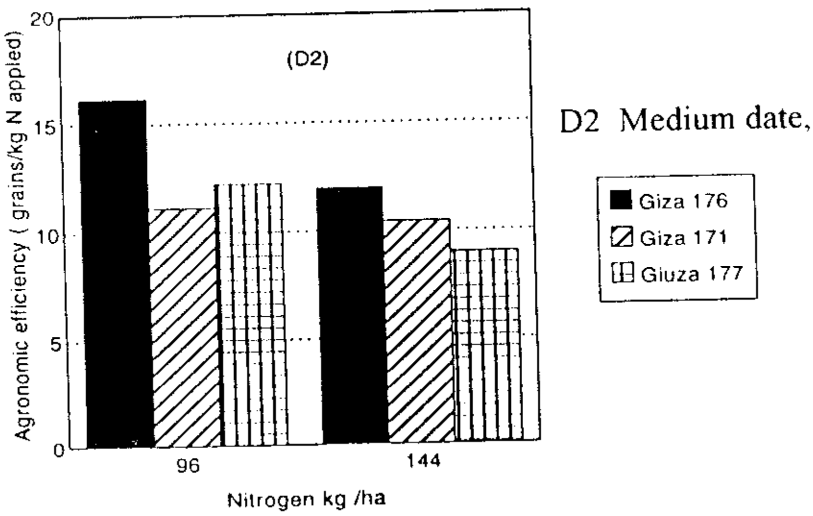
Figure (4) showed that agronomic efficiency (kg grains/ kg N applied) as affected by N levels and rice cultivars at different dates of sowing in the combined analysis over two growing seasons.

Early date of sowing caused an increase in the agronomic efficiency of nitrogen application fertilizer followed by the medium date of sowing, whereas the late date of sowing gave the lowest one.

Moreover, the low level of nitrogen (96 kg N/ ha) gave more agronomic efficiency than the high level of nitrogen (144 kg N/ ha). Thakur (1991) found that N- use efficiency of 19.0 kg grain / kg N.

It was clear from Figure (4) that agronomic efficiency was higher when Giza 176 cultivar received 96 kg N/ ha at different dates of sowing. The application of 96 kg N/ ha to Giza 176 cultivar on the first date of sowing gave the maximum agronomic efficiency, while the minimum one was obtained from the third date with Giza 171 cultivar when received 144 kg N/ ha. The total quantity of N used by the rice plant is related to varietal duration. The long duration rice absorbed more total N and less response to nitrogen fertilizer than shorter duration (De Datta, 1986). Also, Singh and Pillai (1994) found that the





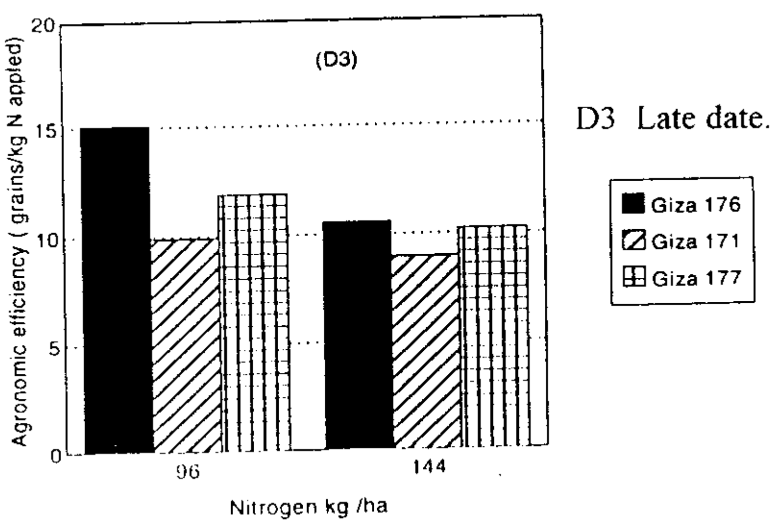


Figure (4): Effect of sowing date, N level and rice cultivar on agronomic efficiency in the combined analysis of 1993 and 1994 seasons.

mean grain yield response to N averaged over different varieties at 30, 60, 90 and 120 kg N/ ha were 22.8, 18.4, 16.8 and 10 kg grain/ kg N, respectively.

8- Number of panicles/ m^2:

Number of panicles/ m^2 as affected by sowing dates, N- levels and rice cultivars in combined data are shown in Table (10).

A- Effect of sowing date:

Table (10) revealed that number of panicles/ m^2 was significantly decreased due to delaying date of sowing. Early sowing at May 15 th gave the highest number of panicles/ m^2 (638.04), whereas late sowing at June, 15 produced the lowest one (518.71). Planting rice on early date increased number of panicles/ m^2 about 23 % when compared with the late date of sowing. This might have been the result of response to photoperiod or temperature. Thus, the late planted rice face short day length, short growth duration and low temperature during its late growth and flowering. These results are in harmony with those obtained by El- Azizi *et al.* (1970), Pande and Tilak (1970), Shaalan *et al.* (1981), Badawy (1982), Badawi and Mahrous (1985), Mahrous *et al.* (1986), El- Hity *et al.* (1987), Assey *et al.* (1992), Abd El- Rahman *et al.* (1992) and El- Kalla *et al.* (1994).

B- Effect of N- level:

The data reported in Table (10) show that number of panicles/ m^2 was significantly increased by increasing nitrogen fertilizer level up to 144 kg N/ ha in the combined data.

Applying 96 and 144 kg N/ ha increased number of panicles/ m^2 by 46.16 % and 64.44 %, respectively over the control. This increment clearly indicated that prominent role of N on vegetative growth, tillering and fertility in rice. These findings were in accordance with those obtained by Dixit *et al.* (1979), Barnes (1985), Badawi and Mahrous (1985), Chandrasekharan and Salem (1985), Abd- El-Rahman *et al.* (1986), Shaalan *et al.* (1986), Badawi *et al.* (1990), El-Kalla *et al.* (1990), Peng and Li (1991), El- Kalla *et al.* (1992), Kreem (1993), Thakur (1993) and Gorgy (1995).

C- Varietal differences:

Results in Table (10) showed that number of panicles/ m^2 was significantly affected by the tested rice cultivars in the combined data.

Giza 176 cultivar gave the maximum number of spikes/ m^2 (606.85) followed by Giza 171 and Giza 177 cultivars (553.19 and 545.85, respectively) without significant difference between Giza 171 and Giza 177 cultivars. Such differences could be attributed to genetic effect. The same trend was found by Dixit *et al.* (1979), El- Hity *et al.* (1987), Badawi *et al.* (1990), El- Kalla *et al.* (1990), El- Kassaby *et al.* (1991), Assey *et al.* (1992), El- Kalla *et al.* (1992), Thakur (1993), El-Kalla *et al.* (1994) and Gorgy (1995).

9- Grain/ straw ratio:

The results in Table (10) indicated that the effect of sowing dates, N- levels and rice cultivars on grain/ straw ratio in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing date:

Grain/ straw ratio was highly significantly affected by the different dates of sowing rice. The highest grain/ straw ratio was 0.71, produced from early date of sowing. Whereas, the lowest one was 0.36 obtained from late date of sowing. Also, early sowing date increased grain/ straw ratio by 97.22 % as compared when sowing at late date. This increase in grain/ straw ratio may be due to increase grain yield and decrease straw yield by early sowing. These results are in harmony with those obtained by Shaalan *et al.* (1981).

B- Effect of N level:

It was clear from Table (10) that the ratio of grain to straw was significantly increased by increasing N level up to 96 kg N/ ha. On the other hand, no significant difference between 96 and 144 kg N/ ha on grain/ straw ratio. The application of 96 kg N/ ha gave the greatest ratio of grain to straw and increased by 19.15 % over the check treatment. The same trend was obtained by Abdella (1985) and Aly *et al.* (1986).

C- Varietal difference:

Data in Table (10) indicated that there was significant difference among the three tested rice cultivar in the ratio of grain to straw in combined data. Giza 176 and Giza 177 cultivar gave the highest grain/ straw ratio. However, both Giza 176 and Giza 177 cultivars produced similar ratio (0.57). On the other hand, Giza 171 cultivar gave the lowest ratio (0.44). These results were expected since Giza 176 cultivar produced higher grain yield than the two other cultivars. Also, Giza 177 produced similar ratio may be due to decreased in straw yield. This result confirmed the previous results of Shaalan *et al.* (1981), Adbella (1985) and Shaalan *et al.* (1986 b).

10- Grain yield (ton)/ ha:

Table (10) showed that grain yield (ton)/ ha as influenced by sowing dates, N- levels and rice cultivars in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing date:

Grain yield (ton)/ ha was significantly affected by date of sowing in the combined data.

The maximum grain yield/ ha was 7.473 ton/ ha produced when sowing at early date (May 15 th). Whereas, the minimum one was 4.603 ton/ ha, obtained when sowing at late date (June, 15 th). The increase in grain yield at early sowing by 62.35 % as compared with the late sowing. The medium sowing also yielded grains more than late sowing with about 21.77 %. The increase of grain yield in early date over late sowing may be attributed to the greater number of panicles/ m^2, panicle length, number of filled grains/ panicle, 1000- grain weight, utilization efficiency, agronomic efficiency and the ratio of grain to straw.

These results are in harmony with those obtained by Singh *et al.* (1969), El- Azizi *et al.* (1970), Singh and Paliwal (1980), Shaalan *et al.* (1981), Badawy (1982), Badawi and Mahrous (1985). Mahrous *et al.* (1986), El- Hity *et al.* (1987), Lee *et al.* (1991), Assey *et al.* (1992), Abd El- Rahman *et al.* (1992), El- Kalla *et al.* (1994) and Singh *et al.* (1995).

B- Effect of N level:

It was evident that grain yield/ ha was significantly increased by increasing nitrogen fertilizer levels up to 144 kg N/ ha in the combined data (Table 10).

The application of 96 and 144 kg N/ ha increased grain yield/ ha by 63.03 % and 82.75 % over the control treatment, respectively.

It could be concluded that the results of grain yield as affected by N levels are similar to those of number of panicles/ m^2, panicle length, number of filled grains/ panicle, 1000- grain weight and grain / straw ratio.

These results are in agreement with those obtained by Gaffer and Chand (1978), Dixit *et al.* (1979), Dixit and Singh (1980), Patil *et al.* (1980), Singh and Paliwal (1980), Martin *et al.* (1982), Barnes (1985), Badawi and Mahrous (1985), Chandrasekharan and Salem (1985), Aly *et al.* (1986), Shaalan *et al.* (1986b), Gill and Shahi (1987), Badawi *et al.* (1990), El- Kalla *et al.* (1990), Singh *et al.* (1991), El- Kalla *et al.* (1992), Koriem *et al.* (1992), Thakur (1993) and Singh and Pillai (1994).

C- Varietal difference:

Table (10) revealed that Giza 176 cultivar surpassed significantly the other two rice cultivars in grain yield/ ha in the combined data. Whereas, Giza 177 cultivar was the worst inferior cultivar among the other tested cultivars. The superiority of Giza 176 cultivar in grain yield/ ha may be due to the increase in number of panicles/ m^2, grain/ straw ratio, panicle length, spikelets formation, number of filled grains/ panicle, utilization efficiency and agronomic efficiency. These results are in accordance with those obtained by Kumbhar and Sonar (1978), Dixit *et al.* (1979), Patel *et al.* (1980), Shaalan *et al.* (1981), Chebataroff *et al.* (1984), Das Gupta and Awoderu (1986), Shaalan *et al.* (1986 a), El- Hity *et al.* (1987), Badawi *et al.* (1990), El- Kalla *et al.* (1990), Assey *et al.* (1992), El- Kalla *et al.* (1992) and El- Kalla *et al.* (1994).

11- Straw yield (ton)/ ha:

Data in Table (10) illustrated that the effect of sowing dates, N- levels and rice cultivars on straw yield (ton)/ ha in the combined analysis of the two growing seasons.

A- Effect of sowing date:

Results in Table (10) emphasize that sowing dates had a significant effect on straw yield/ ha in the combined data. Delaying sowing date from May, 15 to June, 1 or June, 15 significantly increased straw yield/ ha by 4.08 % and 21.98 %, respectively.

These results are not in agreement with those obtained by Abd El- Rahman *et al.* (1992) who reported that the earlier the seeding (May 1 st) the superior the straw yield under salt affected soil.

B- Effect of N level:

Straw yield/ ha was significantly increased by increasing N level up to 144 kg N/ ha in the combined data.

Table (10): Number of panicles/ m^2, grain/ straw ratio, grain and straw yields ton/ ha as affected by sowing dates, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters / Treatments	No. of panicles/ m^2	Grain/ straw ratio	Grain yield (ton)/ ha	Straw yield (ton)/ ha
Sowing dates:				
Early	638.04 a	0.71 a	7.473 a	10.672 c
Medium	549.11 b	0.52 b	5.605 b	11.108 b
Late	518.71 c	0.36 c	4.603 c	13.018 a
N- Level: (kg/ ha)				
00	415.46 c	0.47 b	3.966 c	9.077
96	607.22 b	0.56 a	6.466 b	12.078 b
144	683.18 a	0.56 a	7.248 a	13.643 a
Cultivars:				
Giza 176	606.85 a	0.57 a	6.552 a	11 524 b
Giza 171	553.19 b	0.44 b	5.745 b	13.862 a
Giza 177	545.85 b	0.57 a	5.383 c	9.412 c

The maximum straw yield/ ha was 13.643 ton, produced from application of nitrogen fertilizer at 144 kg N/ ha, whereas the minimum one was 9.077 ton/ ha, obtained from without application of nitrogen fertilizer.

The application of 96 and 144 kg N/ ha increased straw yield/ ha by 33.06 % and 50.30 % over the control treatment, respectively. The increase in straw yield could be attributed to increase in plant height, number of tillers/ m^2 leaf area index and crop growth rate.

These results are in accordance with those found by Gaffer and Chand (1978), Patil *et al.* (1980), El- Kalla *et al.* (1990), Koriem *et al.* (1992) and Thakur (1993).

C- Varietal difference:

The results in Table (10) showed that there was a significant difference between the three cultivars of rice in straw yield/ ha. Giza 171 cultivar gave the greatest straw yield/ ha (13.862 ton), followed by Giza 176 cultivar (11.524 ton). However, Giza 177 cultivar had the lowest straw yield/ ha (9.412 ton). The superiority of Giza 171 cultivar might be attributed to tallest plants, higher number of tillers/ m^2, leaf area index and crop growth rate. These results are confirmed with those obtained by Assey *et al.* (1992).

Interaction effects:

A- Interaction effect between sowing dates and N- levels:

The results in Table (11) revealed that the effect of the interaction between sowing dates and N levels was significant on panicle length, number of unfilled grains/ panicle, number of panicles/ m^2 and grain yield ton/ ha in the combined analysis of 1993 and 1994 seasons. Whereas, number of filled grains/ panicle, 1000- grain weight, grain/ straw ratio, spikelets formation efficiency and straw yield/ ha were not significant by the interaction between the two factors, consequently the data were excluded.

A- 1. Panicle length:

The highest panicle length was 19.75, obtained from sowing at early (May15 th) which received 144 kg N/ ha. However, the lowest one was 14.08 cm, produced from late sowing without application of nitrogen fertilizer.

It could be concluded that early sowing with increasing N level up to 144 kg N/ ha gave the highest panicle length.

A- 2. Number of unfilled grains/ panicle:

Data in Table (11) showed that number of unfilled grains/ panicle was highly significantly affected by the interaction between sowing dates and N- levels.

The maximum number of unfilled grains/ panicle was 15.46, obtained from the late sowing date with applied nitrogen fertilizer at 144 kg N/ ha. Whereas, early sowing without nitrogen fertilizer gave the minimum number of unfilled grains/ panicle (4.67). Also, early date of sowing under different levels of nitrogen gave the lowest number of unfilled grains/ panicle.

Table (11): Some yield components characters and grain yield/ ha. as affected by the interaction between sowing dates and N- levels in combined analysis of 1993 and 1994 seasons.

Characters		Panicle length (cm)	No. of unfilled grains/ panicle	No. of panicle/ m^2	Grain yield (ton)/ ha
Sowing date:	N- level: (kg/ ha)				
Early	00	16.26	4.67	415.46	5.006
	96	18.86	6.2	679.96	8.134
	144	19.75	6.96	818.71	9.279
Medium	00	15.70	7.42	425.50	3.726
	96	17.18	8.83	586.00	6.264
	144	18.19	9.83	635.83	6.824
Late	00	14.08	9.21	405.42	3.167
	96	16.22	14.00	555.71	5.000
	144	16.78	15.46	595.00	5.643
L.S.D at 5%		0.31	0.74	18.81	0.269

A- 3. Number of panicles/ m^2:

Early date at May 15 th with adding 144 kg N/ ha was the highest and significant in number of panicles/ m^2. While, the lowest numbers was 405.42, produced from late date at of June 15 th without application of nitrogen fertilizer in the combined data.

It could be concluded that early date of sowing rice with increasing N level up to 144 kg N/ ha gave the greatest number of panicles/ m^2.

A- 4. Grain yield (ton)/ ha:

The result in Table (11) indicated that there was highly significant difference in grain yield (ton)/ ha due to the interaction between sowing dates and N- levels in the combined data. The greatest grain yield/ ha was 9.279 ton, produced from early sowing with the application of 144 kg N/ ha. Whereas, the minimum grain yield (ton)/ ha was 3.167 ton, obtained from sowing at late date with the control treatment (zero N).

It was clear that early date of sowing with increasing N level up to 144 kg gave the best results of grain yield and yield component characters under study.

B- Interaction effect between sowing dates and cultivars:

The results in Table (12) revealed that the interaction between sowing dates and cultivars had a significant effect for all characters of yield and its components under study in the combined of the two growing seasons.

B- 1. Panicle length:

Rice cultivar Giza 176 gave the tallest panicle (19.71 cm) when sowing at early date. On the other hand, the shortest panicle was 15.11 cm, produced from Giza 177 cultivar sowing at late date. Whereas, no significant difference between Giza 171 and Giza 177 cultivars when delaying sowing at late date. The late planted rice meet short day length and low temperature during its late growth so, flowering as well as panicle length.

B- 2. Number of filled grains/ panicle:

The highest number of filled grains/ panicle was 107.54, obtained from Giza 176 cultivar when sowing at early date. Whereas the lowest number was 64.12, produced from Giza 177 cultivar when sowing at late date. Also, Giza 177 at different dates of sowing gave the minimum number of filled grains/ panicle as compared with the other rice cultivars. On the other hand, the differences between Giza 171 and Giza 176 cultivars at late date of sowing were not significant on number of filled grains/ panicle.

B- 3. Number of unfilled grains/ panicle:

Data in Table (12) showed that number of unfilled grains/ panicle was significantly affected by the interaction between sowing dates and rice cultivars in the combined data. The highest number of unfilled grains/ panicle was 15.08, obtained from late sowing of Giza 176 cultivar, while the lowest value (5) was produced when Giza 177 cultivar was sown at early date (May 15 th).

It could be attributed to the restriction of anthesis process and the decline in the filling of grains as a result to the low temperature in the late of sowing.

B- 4. 1000- grain weight:

The interaction between sowing dates and rice cultivars gave a significant effect on 1000- grain weight in the combined data as shown in Table (12).

Giza 177 cultivar when sowing at early and medium date gave the highest weight of 1000- grain, whereas Giza 171 cultivar when grow late had the lowest weight of 1000- grain. The difference between Giza 171 and Giza 177 cultivar when sowing at early were not significant on 1000- grain weight.

B- 5. Spikelets formation efficiency:

Spikelets formation efficiency was significantly influenced by the interaction between sowing dates and rice cultivars (Table 12, and Figure 5). Giza 176 cultivar was superior in number of spikelets/ g N absorbed (3179.29) compared with the other rice cultivar when planting at early date. Whereas no significant difference between the three cultivars when sowing at medium or late date on number of spikelets/ g N absorbed. Giza 177 cultivar when planting at late date (June, 15) gave the minimum number (2565.29).

B- 6. Number of panicles/ m^2:

The data in Table (12) indicated that the effect of the interaction between sowing dates and rice cultivars were highly significant on

Table (12): Some yield components, grain and straw yields ton/ ha as affected by the interaction between sowing dates and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		Panicle length (cm)	No. of filled grains/ panicle	No. of unfilled grains/ panicle	1000-grain weight	Spikelets formation efficiency	No. of panicles/ m2	Grain/ straw ratio	Grain yield (ton/ ha)	Straw yield ton/ ha
Sowing dates:	Cultivars:									
Early	Giza 176	19.71	107.54	7.04	25.64	3179.29	667.67	0.79	8.944	11.177
	Giza 171	19.10	96.87	6.00	25.96	2909.46	642.25	0.62	7.505	12.330
	Giza 177	16.07	73.25	5.00	28.07	2631.58	604.21	0.69	5.970	8.508
Medium	Giza 176	18.18	90.71	9.92	24.40	2774.29	596.67	0.55	5.837	10.516
	Giza 171	16.93	85.54	9.46	23.27	2728.33	529.33	0.41	5.486	13.492
	Giza 177	15.95	70.21	6.71	28.37	2778.29	521.33	0.58	5.491	9.317
Late	Giza 176	16.65	74.62	15.08	22.52	2630.62	556.21	0.37	4.876	12.878
	Giza 171	15.34	72.79	13.33	21.17	2568.87	488.00	0.27	4.246	15.766
	Giza 177	15.11	64.12	10.25	25.35	2565.29	511.92	0.45	4.688	10.410
L.S.D. at 5%		0.30	4.52	0.62	0.48	136.34	16.48	0.03	0.211	0.466

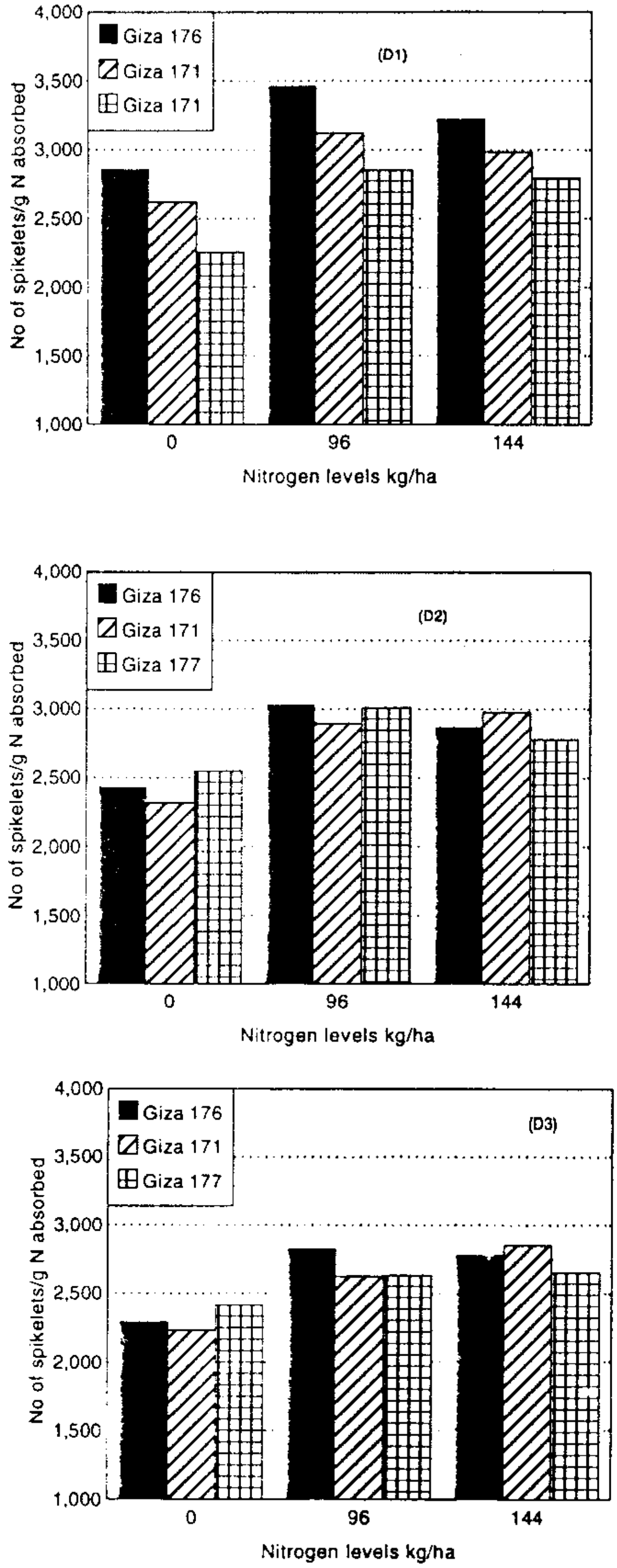
number of panicles/ m^2 in the combined data. Early sowing to Giza 176 cultivar gave the greatest number of panicles/ m2 (667.67). Whereas the lowest one was 488, obtained from Giza 171 cultivar when sowing at late. Similar results were obtained by Badawi and Mahrous (1985) and Assey *et al.* (1992).

B- 7. Grain/ straw ratio:

The ratio of grain to straw was significantly affected by the interaction between sowing dates and rice cultivars in combined analysis of the two growing seasons (Table 12). The trend of results for the effect of the interaction between sowing dates and rice cultivars are similar to those of number of panicles/ m^2 The highest ratio of grain to straw was 0.79 produced from early sowing with Giza 176 cultivar. However, the lowest ratio was 0.27 obtained from late sowing with Giza 171 cultivar.

B- 8. Grain yield (ton)/ ha:

The data in Table (12) showed that the interaction between sowing dates and rice cultivars were significant on grain yield (ton)/ ha in the combined of 1993 and 1994 seasons. Early date of sowing to Giza 176 cultivar gave the maximum grain yield/ ha (8.944 ton), whereas the late date of sowing for Giza 171 cultivar had the minimum grain yield/ ha (4.246 ton). On the other hand, no significant difference between Giza 171 and Giza 177 cultivar when sowing at medium date or between Giza 176 and Giza 177 cultivar when sowing at late date on grain yield/ ha. This increase may be attributed to increases panicle length, number of filled grains/ panicle, number of spikelets, number of



D1 Early date,

D2 Medium date,

D3 Late date.

Figure (5): Effect of sowing date, N level and rice cultivar on spikelets formation efficiency in the combined analysis of 1993 and 1994 seasons panicles/ m^2 and the ratio of grain to straw. The low yields of these cultivars in the third date may be due to their sensitivity to temperature and short day length which adversely influenced their growth. Badawi and Mahrous (1985), El- Hity *et al.* (1987) and Assey *et al.* (1992).

B- 9. Straw yield (ton)/ ha:

Straw yield/ ha was significantly affected by the interaction between sowing dates and rice cultivars in the combined data (Table 12). The highest straw yield/ ha was 15.766 ton, obtained when sowing at June, 15 with Giza 171 cultivar. While the lowest one was 8.508 ton, produced by Giza 177 cultivar when sowing at early date (May 15 th). This increase may be due to increase in plant height, number of days to 50 % heading and decrease panicle length and the ratio of grain to straw when Giza 171 cultivar sowing at late date.

C- Interaction effect between N- levels and cultivars:

The results in Table (13) indicated that panicle length, number of panicles/ m^2, grain/ straw ratio, grain yield/ ha and straw yield were significantly affected by the interaction between N levels and cultivars in the combined of the two growing seasons. On the contrary, the interaction between the two factors was not significant on number of filled grains/ panicle, number of unfilled grains/ panicle, spikelets formation efficiency and the ratio of grain to straw, consequently the data were excluded.

C- 1. Panicle length:

It was clear from Table (13) revealed that the tallest panicle was 19.66 cm, produced from adding 144 kg N/ ha to Giza 176 cultivar.

Whereas the shortest panicle was 14.29 cm, obtained from Giza 177 cultivar without application of nitrogen fertilizer. Similar observations were stated by Shaalan *et al.* (1986b) and El- Kalla *et al.* (1992).

C- 2. Number of panicles/ m^2:

There was a significant difference between the interaction between N levels and rice cultivars on number of panicles/ m^2 as shown in Table (13). Application of nitrogen fertilizer at 144 kg N/ ha gave the maximum number of panicles/ m^2 (717.04), whereas the minimum number of panicles/ m^2 was 401.87 and 403.29, obtained from Giza 171 and Giza 177 cultivars, respectively without nitrogen fertilizer. Similar results were reported by Shaalan *et al.* (1986b), El-Kalla *et al.* (1992) and Gorgy (1995).

C- 3. Grain/ straw ratio:

Data in Table (13) showed that the ratio of grain to straw was significantly influenced by the interaction between N levels and rice cultivars in the combined data. The highest ratio was 0.63, obtained from adding 96 kg N/ ha to Giza 177 cultivar. On the other hand, no significant difference between Giza 176 or Giza 177 which received 144 kg N/ ha. Also, the interaction between applied 96 kg N/ ha to Giza 177 cultivar and the interaction between Giza 176 or Giza 177 cultivar which received 144 kg N/ ha were not significant in grain/straw ratio, whereas the lowest ratio of grain to straw ratio was 0.41, produced from without nitrogen fertilizer and Giza 171 cultivar. On the contrary, Abdella (1985) found that non-significant interaction between

N levels and cultivars suggested that the cultivars responded similarly to the nitrogen levels, regarding grain/ straw ratio.

C- 4. Grain yield (ton)/ ha:

The interaction between N levels and rice cultivars had a significant effect on grain yield/ ha in the combined data are presented in Table (13). In general, the grain yield of the three rice cultivars was increased with increasing N levels up to 144 kg N/ ha. Giza 176 cultivar with received 144 kg N/ ha gave the maximum grain yield/ ha (8.205 ton), whereas Giza 171 cultivar without fertilization of nitrogen gave the minimum one (3.970 ton).

It could be concluded that Giza 176 cultivar was more responsive to excessive nitrogen levels up to 144 kg N/ ha.

These results are in accordance with those obtained by Abdella (1985), Shaalan *et al.* (1986b), El- Kalla *et al.* (1992) and Gorgy (1995).

C- 5. Straw yields (ton)/ ha:

Straw yield/ ha was significantly increased by increasing N level up to 144 kg N/ ha with the tested rice cultivars in the combined analysis of the two seasons. The highest straw yield/ ha was 16.396 ton, obtained from Giza 171 cultivar with received 144 N/ ha. However, the lowest one was 7.771 ton/ ha, obtained from Giza 177 cultivar with the check treatment. The increase in straw yield due to increase in plant height, dry matter and decrease the ratio of grain to straw.

Table (13): Some yield components characters, grain and straw yields/ ha as affected by the interaction between N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		Panicle length (cm)	No. of panicle/ m2	Grain/ straw ratio	Grain yield (ton)/ ha	Straw yield (ton)/ ha
N- level: (kg/ ha)	Cultivars:					
00	Giza 176	16.20	441.21	0.52	4.270	8.703
	Giza 171	15.56	401.87	0.41	3.970	10.756
	Giza 177	14.29	403.29	0.48	3.659	7.771
96	Giza 176	18.68	662.29	0.58	7.182	12.157
	Giza 171	17.44	592.87	0.46	6.294	14.435
	Giza 177	16.14	566.50	0.63	5.923	9.643
144	Giza 176	19.66	717.04	0.61	8.205	13.711
	Giza 171	18.37	664.83	0.44	6.972	16.396
	Giza 177	16.71	667.67	0.62	6.568	10.822
L.S.D at 5%		0.30	16.48	0.03	0.209	0.466

D- Interaction between sowing dates, N- levels and cultivars:

Table (14) illustrated that panicle length, grain/ straw ratio, grain yield/ ha and straw yield/ ha were significantly affected by the interaction between sowing dates, N levels and rice cultivars in the combined data. Whereas, the other characters of yield components were not significantly affected by the interaction between the three factors, consequently their data were excluded.

D- 1. Panicle length:

Early sowing at May 15 th to Giza 176 cultivar with applied 144 kg N/ ha gave the tallest panicle (21.51 cm), whereas the shortest panicle was 13.42 cm, obtained from Giza 177 cultivar when sowing at late date without application of nitrogen fertilizer. On the other hand, no significant difference between early sowing with Giza 176 and Giza 171 cultivar when received 96 and 144 kg N/ ha, respectively on panicle length.

It could be concluded that Giza 176 and Giza 171 cultivar when early sowing and increasing N level up to 144 kg N/ ha produced tallest panicle.

D- 2. Grain / straw ratio:

The results in Table (14) indicated that the ratio of grain to straw was highly significant as affected by the interaction between sowing dates, N- levels and rice cultivars. The maximum grain/ straw ratio was 0.87, produced from sowing at early (May 15 th) and applied 144 kg N/ ha with Giza 176 cultivar. On the other hand, the minimum grain/ straw ratio was 0.26, obtained from sowing at late (June 15 th) without N for Giza 171 cultivar. However, no significant difference between different levels of nitrogen for Giza 171 cultivar when late sowing on the ratio of grain to straw.

D- 3. Grain yield (ton)/ ha:

Giza 176 cultivar when early sowing and received 144 kg N/ ha surpassed significantly in grain yield/ ha (11.665 ton) as compared with the other interaction of sowing dates, N levels and rice cultivars (Table 14). Whereas sowing at late date without N fertilizer with the three tested cultivars gave the minimum grain yield/ ha. Also, no significant difference between the three cultivars when sowing at medium date of (June 1 st) without application of nitrogen.

D- 4. Straw yield (ton)/ ha:

A significant effect of the interaction between sowing dates, N- levels and rice cultivars on straw yield (ton)/ ha was observed in the combined of the two growing seasons as shown in Table (14). It was evident that the maximum straw yield / ha was 17.866 ton, produced from Giza 171 cultivar when sowing at late date and applied 144 kg N/ ha. Whereas the minimum one was 7.033 ton/ ha, obtained from Giza 177 cultivar when sowing at early date without application of nitrogen fertilizer. On the other hand, the interaction between Giza 176 and Giza 177 cultivars when sowing at early or medium without N fertilizer on straw yield/ ha were not significant.

Table (14): Panicle length, grain / straw ratio, grain and straw yields (ton / ha) as affected by the interaction between sowing dates, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		Panicle length (cm)			Grain/ straw ratio			Grain yield (ton)/ha			Straw yield (ton)/ ha		
Cultivars		G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177
Sowing dates:	**N- levels: kg/ ha**												
Early	00	17.22	16.79	14.77	0.73	0.62	0.59	5.676	5.196	4.145	7.870	9.089	7.035
	96	20.39	19.75	16.45	0.77	0.65	0.76	9.491	8.396	6.515	12.056	13.065	8.549
	144	21.51	20.75	17.00	0.87	0.61	0.73	11.665	8.921	7.251	13.604	14.835	9.941
Medium	00	16.70	15.72	14.66	0.49	0.37	0.49	3.778	3.683	3.718	8.054	10.273	7.593
	96	18.50	16.91	16.14	0.58	0.45	0.62	6.674	5.988	6.131	11.573	13.715	9.881
	144	19.35	18.17	17.06	0.59	0.41	0.63	7.059	6.787	6.625	11.921	16.488	10.476
Late	00	14.66	14.17	13.42	0.34	0.26	0.36	3.355	3.032	3.115	10.185	12.906	8.685
	96	17.17	15.67	15.84	0.38	0.27	0.50	5.380	4.498	5.123	12.843	16.526	10.499
	144	18.11	16.18	16.06	0.38	0.29	0.48	5.893	5.208	5.827	15.608	17.866	12.047
L.S.D at 5%			0.51			0.05			0.366			0.807	

III- Chemical and technological properties:

1- N- uptake in grains:

The effect of sowing date, N- level and rice cultivar on N uptake in grains in combined analysis of the two growing seasons are shown in Table (15).

A- Effect of sowing date:

N- uptake in rice grains was significantly decreased by delaying in date of sowing. Early sowing at May, 15 gave the highest uptake in grains (75.99 kg), whereas the lowest one was 53.10 kg produced from sowing at late (June, 15). Early sowing and medium sowing increased N- uptake in grain by 43.11 % and 14.97 %, respectively over the late sowing. These results may be due to increasing grain yield of rice when sown at early date.

B- Effect of N level:

Data in Table (15) revealed that N- uptake in grains tended to increase significantly as N levels increase. The application of 96 and 144 kg N/ ha increased N uptake in grain by 75.19 5 and 118.84 %, respectively over the control treatment. The increase in N- uptake of rice grains may be due to the increase in available- N- around root zone and the accumulation of N in the sheath, leaves and stems at (P1). These results are in agreement with the results reported by Barnes (1985), Dubey and Bisen (1989), Singh *et al.* (1991), they found that N content and uptake in rice grains were increased with N application.

C- Vareital differences:

Giza 176 cultivar surpassed significantly the other tested cultivars in N uptake in rice grain in the combined data (Table 15). On the other hand, no significant difference between Giza 171 and Giza 177 cultivars in N uptake in rice grains. The lowest uptake of nitrogen in grains was 60.76 kg N/ ha, obtained from Giza 177 cultivar. The superiority of Giza 171 cultivar in N uptake might be attributed to increase in grain yield. Rico and De Datta (1982) stated that later maturing cultivars had higher soil N uptake than the early or medium maturing cultivars.

2- N uptake in straw:

Table (15) illustrated that N uptake in straw as affected by sowing dates, N- levels and rice cultivars in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing dates:

N- uptake in straw was significantly affected by sowing date treatments in the combined data as shown in Table (15). Late sowing on June 15 th gave the maximum N uptake in straw (73.16 kg), whereas early sowing at May 15 th produced the minimum one (36.45 kg). The increase in N- uptake in straw may be due to increase in straw yield by delaying in date of sowing. Tanaka (1964) reported that nutrient uptake by the plant was controlled by 3 factors (i) nutrient availability in the soil, (ii) nutrient absorbing power of the roots at various growth stages, and (iii) the rate of increase in dry weight.

B- Effect of N levels:

Data in Table (15) indicated that N- uptake in straw of rice was significantly increased by increasing N level up to 144 kg N/ ha in the combined data. The application of 96 and 144 kg N/ ha increased N-uptake in straw by 78.83 and 127.63 %, respectively over the check treatment. The increase N uptake in straw may be due to the increase in straw yield and N content in straw by increasing N levels. Similar trend was obtained by Barnes (1985) and Singh *et al.* (1991).

C- Varietal differences:

Data in Table (15) revealed that N- uptake in straw was significantly influenced by rice cultivars under study in the combined data. Giza 171 cultivar surpassed the other tested cultivars on N uptake in straw, followed by Giza 176 cultivar. Whereas, the lowest N uptake in straw was obtained from Giza 177 cultivar. Such superiority in Giza 176 cultivars in N uptake in straw may be due to the fact that Giza 176 cultivar has more straw yield than the other tested cultivars. Patnaik and Nanda (1969) found that the process of absorption of different nutrients in relation to growth of 4 rice varieties has been worked out from the data on dry weight and nutrient content. Also, Dubey and Bisen (1989) indicated that N content in the straw was highest in cv. Kranti (0.375 %).

3- Protein content:

The effect of sowing dates, N- levels and rice cultivars on protein content in rice grains in combined analysis of the two growing seasons are presented in Table (15).

A- Effect of sowing dates:

Protein content in rice grains was significantly increased by delaying date of sowing up to June 15 th (Table 15).

Sowing rice on June 15 th produced the higher protein content in grains (6.76 %). However, sowing rice on May 15 th produced the lower protein content (6.01 %). It could be concluded that sowing rice at late date (June 15 th) is more preferable for producing high content of protein in grains. These results may be due to the effect of suitable temperature degrees during the grain filling stage which increasing N content in grains. These results are in harmony with those obtained by Nada *et al.* (1977) who found that the grain protein content was maximum with July sowing.

B- Effect of N- level:

The results in Table (15) indicated that the effect of nitrogen fertilizer level on protein content in rice grains was significant in combined analysis of the two seasons (1993 and 1994 season). The maximum protein content was 6.99 %, produced from received 144 kg N/ ha. Whereas, the minimum one was 5.83 %, obtained from no nitrogen fertilizer. These results agree with those of El- Kalla *et al.* (1990), Singh *et al.* (1991), El- Kalla *et al.* (1992), and Gorgy (1995), they found that protein content in rice grains increased significantly when nitrogen level increased.

C- Varietal differences:

The tested rice cultivars were significantly varied in protein content in rice grains in the combined data (Table 15). Giza 177 cultivar surpassed significantly the other rice cultivars in protein content followed by Giza 171 cultivar. However, Giza 176 cultivar was significantly inferior in this trait compared with Giza 171 and Giza 176 cultivars.

Such results may be due to the genetical constitutions of the evaluated cultivars and their interaction with the prevailing environmental conditions. Similar results were reported by El- Kalla *et al.* (1990), El- Kassaby *et al.* (1991) and Gorgy (1995).

4- Protein yield (kg)/ ha:

Data in Table (15) illustrated that protein yield/ ha as affected by sowing dates, N- levels and rice cultivars in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing dates:

Protein yield/ ha was significantly affected by the tested sowing dates (Table 15). The effect of sowing dates on protein yield was similar to that obtained on grain yield/ ha (Table 13).

It was clear that early sowing date at May 15 th produced the highest protein yield/ ha which equal 452.28 kg/ ha, whereas the lowest one was 314.56 kg/ ha, obtained from sowing at late date (June, 15). The increase protein yield/ ha may be due to the increase in grain yield by sowing rice plants at early date.

B- Effect of N levels:

Table (15) showed that protein yield/ ha was significantly increased by increasing N level up to 144 kg/ ha in the combined data.

Table (15): N- uptake in grains and straw, crude protein % and protein yield kg/ ha. as affected by sowing dates, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters / Treatments	N- uptake in grains	N- uptake in straw	Crude protein %	Protein yield kg/ ha
Sowing dates:				
Early	75.99 a	36.45 c	6.01 c	452.28 a
Medium	61.05 b	51.84 b	6.37 b	362.05 b
Late	53.10 c	73.16 a	6.76 a	314.56 c
N- Level: (kg/ ha)				
00	38.49 c	31.88 c	5.83 c	229.07 c
96	67.43 b	57.01 b	6.32 b	401.51 b
144	84.23 a	72.57 a	6.99 a	498.32 a
Cultivars:				
Giza 176	67.99 a	54.40 b	6.21 c	404.98 a
Giza 171	61.40 b	59.95 a	6.38 b	365.95 b
Giza 177	60.76 b	47.11 c	6.54 a	357.97 b

The application of 96 and 144 kg N/ ha increased protein yield/ ha by 75.28 % and 117.54 %, respectively over the control treatment. This increase may be due to increases in protein content and grain yield/ ha as affected by increasing N- level. The same trend was obtained by El-Kalla *et al.* (1990), Singh *et al.* (1991), El- Kalla *et al.* (1992) and Gorgy (1995).

C- Varietal differences:

Data presented in Table (15) indicated that there were significant differences among the tested rice cultivar in protein yield/ ha in the combined analysis of the two growing seasons. Giza 176 cultivar gave the maximum protein yield/ ha (404.98 kg/ ha), whereas the minimum one was 357.77 kg/ ha, produced from Giza 177 cultivar. On the other hand, no significant difference between Giza 171 and Giza 177 cultivars of rice in protein yield/ ha. The superiority of Giza 176 cultivar in protein yield may be due to the fact that Giza 176 cultivar is more grain yield than the other cultivars of rice under study.

5- Hulling percentage:

Hulling percentage as influenced by sowing dates, N- levels and rice cultivars in the combined analysis of 1993 and 1994 seasons are listed in Table (16).

A- Effect of sowing dates:

Table (16) show that hulling percentage was significantly affected by different dates of sowing in the combined data. Medium sowing (June 1 st) gave the highest hulling percentage followed by early sowing on May 15 th, while late sowing on June 15 th gave the lowest one which equal 81.09, 80.70 and 80.33 %, respectively.

Badawy (1982) found that early sowing on April 25 th gave the highest hulling recovery percentage followed by late sowing of June 5. On the other side, Singh *et al.* (1995) indicated that the maximum hulling percentage (76.5 %) was recorded at Aug 4 th. planting.

B- Effect of N levels:

Data recorded in Table (16) indicate that N- levels had a significant effect on hulling percentage in the combined data. The highest percentage of hulling was obtained from applied 96 kg N/ ha. Whereas no significant difference between 96 and 144 kg N/ ha on hulling percentage. The lowest one was produced from no application of nitrogen fertilizer.

The same trend was obtained by Gorgy (1995) who found that hulling recovery percentage tended to increase significantly as N level increase up to 65 kg/ fed.

C- Varietal differences:

Data in Table (16) revealed highly significant differences existed among the tested rice cultivars for hulling percentage in the combined data. Giza 177 cultivar surpassed significantly the other cultivars of rice in hulling percentage. On the contrary, Giza 176 cultivar was significantly inferior in the above character. This fact could be attributed to genetic effect. Gorgy (1995) found that Giza 176 cultivar gave the highest hulling recovery percentage followed by Giza 175 and

IR 28. These variations in hullimg percentage may be due to the differences between the hull weight of the three rice cultivars.

6- Milling recovery percentage:

Results in Table (16) showed that the effect of sowing dates, N-levels and rice cultivars on milling recovery percentage in the combined analysis of the two growing seasons.

A- Effect of sowing dates:

It is obvious that milling recovery percentage was significantly affected by sowing dates (Table 16). The highest milling recovery percentage was 73.82 %, produced from sowing rice at medium date. Whereas, the lowest one was 72.25 %, obtained from sowing rice at latest date. The trend of the results are similar to those of hulling recovery percentage.

It could be concluded that the second date is better than the other two sowing dates in reducing the breakage percentage. Badawy (1982) and Assey *et al.* (1992) indicated that milling out put was higher when sown on 25- 30 April may be due to delaying date of sowing after April increased unhulling grains and the filling of grains was not complete rose up.

B- Effect of N- levels:

Milling percentage of rice was not significantly affected by increasing level of nitrogen fertilizer from zero to 144 kg N/ ha in the combined data (Table 16). Milling percentage of rice was decreased by increasing N level up to 144 kg N/ ha. The same trend was obtained by Dilday (1988) who found that N application reduced the percentage of whole grains after milling. On the contrary, Aly (1986) and Gorgy (1995), they found that a linear significant increase in milling recovery percentage due to the increase of N rates up to 150 kg N/ ha and 65 kg N/ feddan, respectively.

C- Varietal differences:

Data in Table (16) revealed that Giza 177 cultivar gave the highest significant effect in milling percentage as compared with the other tested cultivars in the combined data. Whereas, no significant difference between Giza 171 and Giza 176 cultivars in the above character. The trend of results are similar to those of hulling recovery percentage. Gorgy (1995) showed that Giza 176 cultivar gave the highest milling percentage followed by Giza 175 and IR 28. Also, Assey *et al.* (1992) showed that no significant differences between Giza 171 and IR 28 cultivars concerning milling out put percentage.

7- Head rice percentage:

The data in Table (16) illustrated that head rice percentage as affected by dates of sowing, N- levels and rice cultivars in the combined analysis of 1993 and 1994 seasons.

A- Effect of sowing date:

The results in Table (16) revealed that significant differences were detected among head rice percentage due to sowing dates. Rice sowing on June 1 st produced the higher means of head rice percentage

(68.32 %) followed that sown on May 15 th and June 15 th (67.56 and 67.52 %, respectively). However, no significant differences were obtained between sowing at early or late date on head rice percentage. The trend of results is similar to those of hulling and milling percentage. These results are in harmony with those obtained by Badawy (1982) and Singh *et al.* (1995).

B- Effect of N- levels:

It is clear that, head rice percentage was significantly increased by increasing N level up to 144 kg N/ ha in the combined data (Table 16). The highest percentage of head rice was 68.28 % obtained from applied 144 kg N/ ha. Whereas, no significant differences were detected between adding 96 kg N/ ha and without application on head rice percentage. These results may be due to the increase of protein content which increases by increasing N level and causes the increase of rice grain hardness. These results agree with those of Gorgy (1995) found that head rice percentage tended to increase significantly with increasing N level.

C- Varietal differences:

Table (16) indicate that the differences between the three tested cultivars on head rice percentage was significant in the combined data. Giza 177 cultivar surpassed significantly Giza 171 and Giza 176 cultivars. Whereas, no significant difference was obtained between Giza 171 and Giza 176 cultivars in head rice percentage. The trend of results are similar to those of hulling and milling percentages and such differences could be attributed to genetic make up. Gorgy (1995) indicated that Giza 176 cultivar gave the highest head rice percentage, followed by Giza 175cultivar, where IR 28 cultivar gave the lowest one.

8- Amylose percentage:

The effect of sowing dates, N- levels and rice cultivars on amylose percentage in the combined analysis of 1993 and 1994 seasons are presented in Table (16).

A- Effect of sowing dates:

Amylose percentage was significantly affected by different dates of rice sowing in the combined data. Late date of sowing gave the maximum amylose content, but early date had the minimum one. On the other side, no significant difference was obtained between early date and medium date as well as medium date and late date.

It could be concluded that early and medium date of sowing produced low amylose, whereas late date of sowing gave intermediate amylose content due to amylose content behave in opposite way from protein percentage. Similar results were obtained by Nanda *et al.* (1977) and Badawy (1982).

B- Effect of N-level:

Amylose content did not significantly affected by increasing N level up to 144 kg N/ ha in the combined data. It might be due to the genetic factors. These results are in agreement with the results obtained by Kaul and Raglaaviah (1975).

Table (16): Some technologica l traits of rice as affected by sowing date, N- level and rice cultivar in combined analysis of 1993 and 1994 seasons.

Characters Treatments	Hulling %	Milled rice %	Head rice %	Amylose %	G.C. mm
Sowing dates:					
Early	80.70 b	73.21 b	67.56 b	19.60 b	92.75 a
Medium	81.09 a	73.82 a	68.32 a	19.97 a	90.28 a
Late	80.33 c	72.25 c	67.52 b	20.50 a	91.67 a
N- Level: (kg/ ha)					
00	80.44 b	73.20 a	67.39 b	19.86 a	91.89 a
96	80.85 a	73.05 a	67.72 b	20.27 a	91.38 a
144	80.83 a	73.02 a	68.28 a	19.93 a	91.43 a
Cultivars:					
Giza 176	80.13 c	72.30 b	67.40 b	19.68 a	91.73 a
Giza 171	80.56 b	72.72 b	67.91 a	20.16 a	91.26 a
Giza 177	81.42 a	74.25 a	68.09 a	20.23 a	91.71 a

A- 1. N- uptake in grains:

It is evident from table (17) that early sowing on May 15 *th* with applied 144 kg N/ ha produced the greatest N uptake in rice grains (102.78 kg). Whereas the lowest one was 32.97 kg, obtained from sowing at late date without application of nitrogen fertilizer. This increase in N-uptake in grains may be due to increases grain yield by sowing at early with increasing N level up to 144 kg N/ ha.

In general, N-uptake in grains was higher by increasing N level up to 144 kg N/ ha with early sowing as compared with the other dates of sowing.

A- 2. N-uptake in straw:

Table (17) showed that N-uptake in straw took the opposite way from N uptake in grains. The N-uptake in straw was significantly increased by increasing N level up to 144 kg N/ ha with delay sowing date. The maximum N-uptake in straw was 92.26 kg, produced from late date of sowing at June 15 *th* with received 144 kg N/ ha, while the minimum one was 20.68 kg, obtained from early date of sowing (May 15 *th*) without application of nitrogen fertilizer.

A- 3. Protein percentage:

In general, protein percentage was significantly increased by increasing N levels in different dates of sowing. The highest protein content in rice grains was 7.31% produced from sowing at June, 15 with applied 144 kg N/ ha. Whereas the lowest one 5.55%, obtained from sowing at May, 15 th without application of nitrogen.

Table (17): N- uptake in grain and straw, protein content, protein yield/ ha, head rice % and Gel consistency as affected by the interaction between sowing dates and N- levels in combined analysis of 1993 and 1994 seasons.

Characters		N- uptake in grains	N- uptake in straw	Crude protein %	Protein yield kg/ ha	H.R	G.C
Sowing date:	N- level: (kg/ ha)						
Early	00	46.34	20.68	5.55	276.36	66.87	93.12
	96	78.87	36.82	5.81	468.40	67.40	92.19
	144	102.78	51.86	6.67	612.09	68.42	92.94
Medium	00	36.17	30.41	5.78	215.14	67.53	90.31
	96	66.29	56.52	6.34	397.18	68.47	91.87
	144	80.70	68.59	6.98	473.83	68.95	88.65
Late	00	32.97	44.54	6.18	195.69	67.77	92.23
	96	57.13	77.69	6.79	338.94	67.30	90.08
	144	69.20	92.26	7.31	409.04	67.48	92.71
L.S.D at 5%		3.18	2.59	0.19	24.06	0.76	2.21

It could be concluded that sowing rice at June 1 st with applied 96 kg N/ ha gave the best economic of head rice percentage.

A- 6. Gel consistency (G.C.):

The results in Table (17) indicated that G.C was significantly decreased by increasing N levels and delay in sowing date. The maximum test of G.C was 93.12 mm, obtained from early sowing without N application. Whereas the minimum G.C was 88.65 mm, produced from sowing at medium with received 144 kg N/ ha. On the contrary, no significant difference between early sowing or late sowing with different levels of nitrogen fertilizer in gel consistency test.

It could be concluded that early sowing with unfertilized plants gave the highest gel consistency.

B- Interaction effect between sowing dates and cultivars:

The interaction between sowing dates and tested rice cultivars had a significant effect on all characters studied of chemical and technological properties (Table 18) except amylose content in combined analysis of 1993 and 1994 seasons. Amylose content was not significantly affected by the interaction between the two factors, consequently, the data were excluded.

B- 1. N-uptake in grains:

Table (18) show that Giza 176 cultivar when sown at early date (May 15 th) significantly surpassed (86.28 kg) the other cultivars under different dates of sowing in N-uptake in grains. Whereas, Giza 171 produced from sowing at late date for Giza 171 cultivar. The superiority of Giza 176 when sowing at early date in protein yield/ ha may be due to the increase in grain yield/ ha.

B- 5. Hulling percentage:

The results in table (18) illustrated that hulling percentage was significantly affected by the interaction between sowing dates and rice cultivars in the combined data. Giza 177 cultivar recorded the highest hulling (81.66%) when planted at medium date of sowing (June 1 st), while Giza 176 gave the lowest percentage (79.68%) when sown at late date of sowing. Moreover, insignificant difference in the interaction between the two tested varieties (Giza 177 and Giza 171) and the two dates of sowing (early and medium) was observed in the hulling %.

B- 6. Milling percentage:

The interaction between sowing dates and rice cultivars gave a significant effect on the milling percentage in the combined data as shown in Table (18). The highest percentage of milling was 74.45 %, obtained from medium dates for Giza 177 cultivar. On the other hand, the lowest one was 70.76%, produced from sowing at late with Giza 171 cultivar, however, no significant difference was obtained for Giza 177 between the three dates of sowing.

B- 7. Head rice percentage:

The data in Table (18) indicated that head rice percentage was significant as influenced by the interaction between sowing dates and rice cultivars in the combined data.

Table (18): Some characters of chemical and rice quality as affected by the interaction between sowing dates and cultivars in combined analysis of 1993 and 1994 seasons.

Characters		N- uptake in grains	N- uptake in straw	Protein %	Protein yield kg/ ha	Hulling %	Milling %	H.R	G.C
Sowing dates:	Cultivars:								
Early	Giza 176	86.28	36.94	5.66	513.88	80.00	72.05	66.61	92.60
	Giza 171	77.11	37.54	6.03	458.45	80.65	73.51	67.73	93.50
	Giza 177	64.59	34.89	6.35	384.53	81.43	74.06	68.35	92.15
Medium	Giza 176	61.95	51.21	6.22	368.57	80.72	73.10	68.45	91.17
	Giza 171	58.28	59.06	6.29	349.50	80.89	73.90	69.55	88.46
	Giza 177	62.92	45.25	6.59	368.08	81.66	74.45	66.94	91.21
Late	Giza 176	55.73	75.04	6.76	332.48	79.68	71.76	67.14	91.42
	Giza 171	48.81	83.24	6.83	289.90	80.15	70.76	66.45	91.84
	Giza 177	54.77	61.21	6.69	321.30	81.17	74.24	68.97	91.77
L.S.D at 5%		2.65	2.40	0.15	19.25	0.29	1.17	0.61	1.72

It can be noticed that, sowing Giza 171 cultivar at June 1 st gave the maximum percentage of head rice (69.55%), while Giza 171 cultivar when sowing at June 15 th gave the minimum percentage (66.45 %).

It could be concluded that medium sowing of Giza 171 cultivar gave the best head rice percentage.

B- 8. Gel consistency (G.C):

There was a significant difference of gel consistency (G.C) in the combined analysis due to the interaction between sowing dates and the tested rice cultivars as shown in Table (18). The highest G.C was 93.5 mm, obtained from early sowing with Giza 171 cultivar. Whereas the lowest one was 88.46 mm, produced from medium sowing with Giza 171 cultivar. On the other hand, no significant difference between early sowing or late sowing for the tested rice cultivars in G.C.

C- Interaction effect between N levels and cultivars:

Table (19) illustrated that N-uptake in grains, N-uptake in straw, protein percentage, protein yield kg/ ha, hulling percentage and head rice percentage were significantly affected by the interaction between N levels and rice cultivars in the combined analysis of 1993 and 1994 seasons. While the other technological properties of rice grains, i.e. milling percentage, amylose content and G.C were not affected by the two factors, consequently the data were excluded.

C- 1. N-uptake in grains:

It was clear from Table (19) that Giza 176 cultivar with applied 144 kg N/ ha surpassed significantly the other cultivars with different levels of nitrogen fertilizer. However, the lowest values were obtained from Giza 177 cultivar without application of nitrogen fertilizer. In general the three rice cultivar responded similarly to nitrogen fertilizer and gave the highest values for N-uptake at 144 kg N/ ha. On the other hand, no significant difference between the interaction Giza 171 and Giza 177 cultivars with different level of nitrogen on N- uptake in grains.

C- 2. N-uptake in straw:

The results in Table (19) revealed that N-uptake in straw was significantly influenced by the interaction between N-levels and rice cultivars in the combined data. The maximum N-uptake in straw was 80.41 kg, produced from Giza 171 cultivar with applied 144 kg N/ ha. Whereas, the minimum one was 29.22 kg, obtained from Giza 176 cultivar without application of nitrogen fertilizer.

C- 3. Protein percentage:

The results obviously indicated that Giza 177 cultivar under 144 kg N/ ha level recorded the highest protein percentage in rice grains (7.17%). On the other side, Giza 171 cultivar without N application gave the lowest one (5.91%). Also, the interaction between Giza 171 and Giza 177 cultivars under 144 kg N/ ha level were not significant for protein content in rice grains.

C- 4. Protein yield kg/ ha:

Table (19) show that the three tested cultivars significantly increased protein yield/ ha with increasing N level up to 144 kg N/ ha in combined data. The highest protein yield/ ha was 542.09 kg, obtained from Giza 176 cultivar with applied 144 kg N/ ha, whereas the lowest one was 240.09 kg/ ha, produced from Giza 176 cultivar without application of nitrogen. No significant difference between Giza 176 and Giza 171 cultivars with zero N in protein yield/ ha.

Also, no significant differences for protein yield/ ha were recorded for the interaction between both cultivars Giza 171 and Giza 177 under two levels 96 and 144 kg N/ ha.

C- 5. Hulling percentage:

The data in table (19) illustrated that hulling percentage was significantly affected by the interaction between N levels and rice cultivars in the combined data. The maximum hulling percentage was 81.49 %, obtained from Giza 177 cultivar without N application. However, the minimum one was 79.56%, produced from Giza 171 cultivar under zero N level. The data revealed that there were significant differences between different levels of nitrogen for both Giza 176 and Giza 177 cultivars in hulling percentage.

C- 6. Head rice percentage:

Head rice percentage was significantly affected by the interaction between N levels and rice cultivars in the combined data as shown in Table (19). The highest percentage of head rice was 69.15%, recorded for Giza 177 cultivar under 144 kg N/ ha level. Whereas, the lowest one was 66.78%, produced from Giza 171 cultivar without application of nitrogen fertilizer. On the other hand, no significant

Table (19): N- uptake in grain and straw, protein %, protein yield/ ha, hulling % and head rice as affected by the interaction between N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		N- uptake in grains	N- uptake in straw	Protein %	Protein yield kg/ ha	Hulling %	H.R
N- level: (kg/ ha)	Cultivars:						
00	Giza 176	40.34	29.22	6.66	240.07	80.27	67.71
	Giza 171	38.73	36.40	5.91	230.10	79.56	66.78
	Giza 177	36.40	30.02	5.93	217.03	81.49	67.68
96	Giza 176	72.74	60.50	6.20	432.77	80.02	67.10
	Giza 171	64.22	63.03	6.21	384.18	81.15	68.65
	Giza 177	65.33	47.49	6.53	387.57	81.37	67.44
144	Giza 176	90.88	73.47	6.78	542.09	80.10	67.40
	Giza 171	81.26	80.41	7.02	483.57	80.98	68.30
	Giza 177	80.54	63.83	7.17	469.30	81.40	69.15
L.S.S at 5%		2.65	2.40	0.15	19.25	0.290	0.61

difference was obtained between Giza 176 cultivar with increasing levels of nitrogen up to 144 kg N/ ha.

D- Interaction effect between sowing dates, N-levels and cultivars:

Tables (20 and 21) show that the effect of the interaction between sowing dates, N-levels and rice cultivars were significant on N-uptake in grains, N-uptake in straw, protein percentage, protein yield/ ha hulling percentage, milling percentage and head rice percentage in the combined analysis of the two growing seasons. On the other hand, amylose content and gel consistency (G.C.) were not significantly affected by the interaction between the three factors, consequently the data were excluded.

D- 1. N-uptake in grains:

It was clear that early sowing dates (May 15 th) with Giza 176 cultivar and applied 144 kg N/ ha gave the maximum N-uptake in grains (120.89 kg), whereas late sowing date (June 15 th) with Giza 177 cultivar without application of nitrogen fertilizer gave the minimum one (31.38 kg). However, no significant difference was obtained by the interaction between early sowing or medium sowing or late sowing with the three cultivars without N application in N-uptake in rice grains.

D- 2. N-uptake in straw:

Table (20) indicate that N uptake in straw was significantly influenced by the interaction between sowing dates, N-levels and rice

Table (20): N- uptake in grain and straw, protein% and protein yield (kg)/ ha as affected by the interaction between sowing dates, N- levels and rice cultivars in combined analysis of 1993 and 1994 seasons.

Characters		N- uptake in grains			N- uptake in straw			Protein %			Protein yield kg/ ha		
Cultivars		G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177	G. 176	G. 171	G. 177
Sowing dates:	**N-levels: kg/ ha**												
Early	00	50.91	47.41	40.69	16.20	23.51	22.34	5.33	5.45	5.87	303.04	282.79	243.26
	96	87.26	81.91	67.44	39.72	37.50	33.24	5.47	5.80	6.16	519.05	485.47	400.68
	144	120.69	102.01	85.65	54.89	51.61	49.08	6.16	6.83	7.03	719.55	607.08	509.65
Medium	00	35.67	35.68	37.15	28.17	34.04	29.03	5.61	5.78	5.93	212.17	212.12	221.13
	96	69.79	60.70	68.39	59.87	61.92	47.77	6.22	6.17	6.64	415.26	369.32	406.95
	144	80.40	78.48	83.22	65.59	81.22	58.94	6.83	6.91	7.20	478.29	467.06	476.15
Late	00	34.45	33.09	31.38	43.29	51.65	38.68	6.02	6.50	6.00	204.99	195.39	186.70
	96	61.18	50.04	60.17	81.93	89.67	61.47	6.92	6.66	6.79	364.00	297.75	355.08
	144	71.55	63.29	72.75	99.91	108.40	83.48	7.34	7.32	7.27	428.44	376.57	422.11
L.S.D at 5%		4.58			4.17			0.26			33.35		

cultivars in the combined data. The highest N-uptake in straw was 108.40 kg, obtained from late sowing for Giza 171 cultivar when received 144 kg N/ ha. Whereas, the lowest one was 16.2 kg, produced from early sowing with Giza 176 cultivar without application of nitrogen fertilizer.

D- 3. Protein percentage:

It is evident from Table (20) that the maximum protein percentage was 7.34%, obtained from sowing at late date (June 15 th) with Giza 176 cultivar and applied 144 kg N/ ha. No significant difference was obtained between the three cultivars under sowing at late date and applied 144 kg N/ ha. On the contrary, the minimum protein content in rice grains was 5.33%, produced from Giza 176 cultivar when early sowing date without N fertilizer.

D- 4. Protein yield (kg/ ha):

The interaction effect between sowing dates, N levels and rice cultivars had a significant effect of protein yield/ ha in the combined data. Early sowing plants of Giza 176 cultivar with applied 144 kg N/ ha produced the highest protein yield/ ha (719.55 kg). Whereas, the lowest one was 186.70 kg/ ha, obtained from sowing at late date for Giza 177 cultivar without N fertilizer.

D- 5. Hulling percentage:

The data in Table (21) revealed that hulling percentage was significantly affected by the interaction between the three factors in the combined data. The highest percentage of hulling was 81.85%, obtained from medium sowing at (June 1 st) to Giza 177 cultivar without application of nitrogen fertilizer. However, no significant difference was obtained between early or medium dates of sowing for Giza 177 cultivar and different levels of nitrogen. On the other hand, the lowest hulling percentage was 79.24%, produced from sowing at late with applied 96 kg N/ ha to Giza 176 cultivar.

D- 6. Milling percentage:

There was a significant difference in milling percentage due to the interaction between sowing dates, N-levels and rice cultivars in the combined data (Table 21). The greatest milling percentage was 74.96%, produced from Giza 177 when sowing at June 1 st without nitrogen fertilizer. Whereas, the lowest one was 68.20%, obtained from late sowing with applied 144 kg N/ ha for Giza 171 cultivar.

It could be concluded that Giza 177 cultivar with different dates of sowing and different levels of nitrogen gave the highest milling percentage.

D- 7. Head rice percentage:

The data in Table (21) showed that head rice percentage was significantly affected by the interaction between sowing dates, N-levels and rice cultivars in the combined analysis of the two growing seasons. Giza 171 cultivar in medium sowing date and under 96 kg N/ ha level produced the maximum head rice percentage (71.11%). However, the minimum one was 64.41%, obtained from Giza 171 at late sowing without application of nitrogen fertilizer.

Table (21): Some technological traits as affected by the interaction between sowing dates, N levels and rice cultivars in the combined analysis of 1993 and 1994 seasons.

Characters		Hulling %			Milling %			H.R		
	Cultivars	G. 176	G. 171	G.177	G. 176	G. 171	G.177	G. 176	G. 171	G.177
Sowing date:	N-levels: kg/ ha									
Early	00	80.04	79.49	81.34	72.00	73.32	74.05	65.76	68.05	66.81
	96	80.36	80.76	81.37	72.69	72.32	73.52	68.07	66.41	67.72
	144	79.61	81.71	81.57	71.45	74.89	74.61	65.99	68.74	70.52
Medium	00	80.85	79.89	81.85	73.31	72.94	74.96	68.92	67.89	65.77
	96	80.46	81.60	81.82	72.65	74.57	73.94	66.89	71.11	67.42
	144	80.84	81.19	81.31	73.34	74.19	74.46	69.55	69.66	67.62
Late	00	79.94	79.30	81.27	72.57	70.95	74.72	68.44	64.41	70.45
	96	79.24	81.10	80.91	71.12	73.14	73.52	66.32	68.41	67.16
	144	79.86	80.05	81.32	71.59	68.20	74.46	66.65	66.51	69.29
L.S.D at 5%		0.50			2.02			3.8		

V- Simple correlation

The correlation coefficient between grain yield and each studied characters as well as between all the traits in the combined analysis of 1993 and 1994 seasons are presented in Table (22).

Positive and significant correlation coefficients were detected between number of tillers/ m^2 and plant height (r= 0.590**) or between leaf area index and each of plant height (r=0.708**) and number of tillers (r= 0.760**). Similar results were obtained by Assey *et al.* (1992) who found that plant height was significantly correlated with each of plant dry weight and number of tillers/ m^2.

The results clearly indicated that heading date was highly and significantly correlated with each of plant height (r= 0.734**), number of tillers/ m^2 (r= 0.977**) and LAI (r= 0.839**). Also, number of panicles/ m^2 was significantly and positively correlated with each of plant height (r= 0.592**), number of tillers/m^2 (r= 0.978**), LAI (r= 0.716**) and heading date (r= 0.425*). The same trend was obtained by El-Hity *et al.* (1992).

The association between panicle length and each of plant height, number of tillers, LAI, heading date and number of panicles/ m^2 was highly significant. The respective correlations were 0.620**, 0.877**, 0.909**, 0.756*8 and 0.844**, respectively. Also, positive and significant correlations were detected between 1000- grain weight and each of number of tillers/ m^2 (r= 0.446*) and number of panicles/ m^2 (r= 0.446*). Whereas, negative correlation was obtained between 1000- grain weight and heading date (r=- 0.043). Number of unfilled grains/ panicle was highly and negatively correlated with 1000- grain weight (r= - 0.535**).

Positive and highly significant correlation coefficients were obtained between number of filled grains/ panicle and each of plant height (r = 0.610**), number of tillers/ m2 (r = 0.676**), LAI (r= 0.989**), heading date (r= 0.881**), number of panicle/ m^2 (r= 0.604**) and panicle length (r= 0.911**).

The association between spikelets formation efficiency and each of plant height, number of tillers/ m^2, LAI, heading date, number of panicles/ m^2, panicle length and number of filled grains/ panicle were positive and significant being 0.573**, 0.778**, 0.551**, 0.800**, 0.930** and 0.767**, respectively.

Protein yield/ ha was positively and significantly correlated with plant height (r= 0.630**), number of tillers/ m^2 (r= 0.952**), LAI (r= 0.758**), heading date (r= 0.480*), number of panicles/ m^2 (r= 0.954**), panicle length (r= 0.872**), 1000- grain weight (r= 0.513**), number of filled grains/ panicle (r= 0.681**), spikelets formation (r= 0.838**) and crude protein % (r= 0.425*). Ullah and Khondaker (1988) found that there was a significant positive correlation between protein content and straw yield(r = 0.790**).

Straw yield ton/ ha was significantly and positively correlated with each of plant height, number of tillers/ m2, LAI, number of panicles/ m^2, panicle length, number of unfilled grains/ panicle, spikelets formation, crude protein % and protein yield/ ha. Whereas, negative and significant correlation coefficient were detected between straw yield/ ha and 1000-grain weight (r= 0.387*). Also, the association between the ratio of grain to straw and each of number of tillers/ m^2, LAI, heading date, number of panicles/ m^2, panicle length, 1000- grain weight, number of filled grains/ panicle, spikelets formation and protein yield. However, negative and significant correlation coefficients were showed between the ratio of grains to straw and number of unfilled grains/ panicle (r= 0.619**).

The results indicated that grain yield/ ha was positive and highly significantly correlated with each of plant height (r= 0.609**), number of tillers/ m^2 (r= 0.923**), LAI (r= 0.830**), heading date (r= 0.606**), number of panicles/ m^2 (r= 0.905**), panicle length (r= 0.921**), 1000-grain weight (r=0.502**), number of filled grains/ panicle (r=0.791**), spikelets formation (r= 0.888**), protein yield (r= 0.961**) and the ratio of grain to straw (r= 0.700**). Such results indicate that selection for any of these characters will certainly lead to the increase in the grain yield (ton/ ha.).

Similar results were obtained by Assey et al (1992) who found that grain yield of rice/ feddan was highly and significantly correlated with each of number of panicles/ m^2, 1000- grain weight, number of grains/ panicle, straw yield and milling output. Also, Rana (1986) and Aidy *et al*. (1992) showed that correlation coefficient was highly significant and positive between grain yield versus panicle length, panicle weight and filled grains/ panicle.

Table (22): Correlation coefficient between grain yield (ton)/ ha and the other studied traits of rice in combined analysis of 1993 and 1994 seasons.

Characters	Plant height (cm)	No. of tillers m²	LAI	Heading date (days)	No. of panicle/ m²	Panicle length (cm)	1000-grain weight (g)	No. of unfilled grains panicle	No. of filled grains panicle	Spikelet formation efficiency	Crude protein %	Protein yield kg ha	Straw yiels ha (ton)	Grain straw ratio	Grain yield ha (ton)
Plant height (cm)	1.000														
No. of tillers/ m²	0.590**	1.000													
LAI	0.708**	0.760**	1.000												
Heading date	0.734**	0.497**	0.839**	1.000											
No. of panicle/ m²	0.592**	0.978**	0.716**	0.425*	1.000										
Panicle length	0.620**	0.877**	0.909**	0.756**	0.844**	1.000									
1000- grain weight	0.046	0.446**	0.114	-0.034	0.446*	0.314	1.000								
No. of unfilled grain	0.015	0.030	0.001	-0.197	0.103	0.013	-0.535**	1.000							
No. of filled grain	0.610**	0.676**	0.938**	0.881**	0.604**	0.911**	0.132	0.070	1.000						
Spikelet formation	0.573**	0.778**	0.778**	0.551**	0.800**	0.939**	0.378	0.021	0.767**	1.000					
Crude protein %	0.226	0.358*	-0.000	-0.293	0.449*	0.112	0.162	0.608	-0.137	0.182	1.000				
Protein yield (kg)	0.630**	0.952**	0.758**	0.480*	0.954**	0.872**	0.513**	0.041	0.681**	0.838**	0.425*	1.000			
Straw yield (ton)	0.668**	0.385*	0.497**	0.336	0.451*	0.396*	-0.387*	0.697**	0.336	0.405*	0.541**	0.444*	1.000		
Grain/ straw ratio	0.182	0.612**	0.460*	0.380*	0.538**	0.595**	0.771**	-0.619**	0.545**	0.592**	-0.220	0.611**	-0.369	1.000	
Grain yield (ton)/ ha	0.609**	0.923**	0.830**	0.606**	0.905**	0.921**	0.502**	-0.111	0.791**	0.888**	0.171	0.961**	0.333	0.730**	1.000